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AFGHANISTAN

ENGINEERING SUPPORT PROGRAM

Contract No. EDH-I-00-08-00027-00

Task Order No. 1

Work Order LT-0083 AMD 2 Task 3

Kandahar Area Diesel Optimization



June 16, 2015

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It was prepared by Tetra Tech, Inc.

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June 16, 2015

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Re: Contract No. EDH-I-00-08-00027-00 / Task Order No. 1
Afghanistan Engineering Support Program (AESP)

**Work Order LT0083 Amendment 2, Task 3 Final Report
Kandahar Area Diesel Optimization - Technical Documents Report**

[REDACTED]
Please find enclosed our final report for WO-LT-0083 Amendment 2, Task 3. This submission completes the Task 3 Scope of Work for this Amendment.

This technical documents report is based upon an earlier report from Task 2 titled: *Kandahar Area Diesel Optimization - Generator Analysis Report*, which is a study with recommendations for the economical and sustainable operation of diesel generators in the Kandahar Area.

This Task 3 report is being published in the form of Section 6 Technical Documents and is suitable for insertion into the DABS standard Works Request for Proposal (RFP) format. Appendix C herein includes the pricing schedules that would be used in Section 4 of the DABS standard Works RFP format.

This document provides a technical scope of work with supporting engineering documents, drawings and specifications in sufficient detail to support a RFP for a supplier to engineer, procure, and construct the specified Energy Recovery System (ERS) on selected Kandahar area diesel generators.

Please do not hesitate to contact me should you have any questions or comments regarding this report.

Respectfully,
Tetra Tech, Inc.

[REDACTED]
Chief of Party (AESP)

cc: Kevin Pieters (USAID OEGI)

PART II REQUIREMENTS

Section 6- Employer's Requirements

AFGHANISTAN ENGINEERING SUPPORT PROGRAM

KANDAHAR AREA DIESEL OPTIMIZATION

REQUEST FOR PROPOSALS

TECHNICAL SECTION

RFP NO: DABS-94-ICB-xxx

**RFP TITLE: KANDAHAR AREA DIESEL
OPTIMIZATION**

AFG No: 830021

DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

TABLE OF CONTENTS

| | | |
|------------|---|----------|
| 1.0 | EXECUTIVE SUMMARY | 4 |
| 2.0 | ACRONYMS | 6 |
| 3.0 | TECHNICAL SPECIFICATION..... | 8 |
| 3.1 | Project Description | 8 |
| 3.1.1 | Overview | 8 |
| 3.1.2 | Energy Recovery System..... | 8 |
| 3.1.3 | Coordination Activities..... | 8 |
| 3.1.4 | Code, Standards, Specifications | 8 |
| 3.1.5 | Equipment and Materials..... | 9 |
| 3.1.6 | Workmanship | 9 |
| 3.1.7 | Design and Engineering..... | 9 |
| 3.1.8 | System Characteristics and Climatic Conditions..... | 10 |
| 3.1.9 | Language | 10 |
| 3.1.10 | System of Units..... | 10 |
| 3.1.11 | Documentation..... | 11 |
| 3.1.12 | Progress Reports | 13 |
| 3.1.13 | Manufacture | 13 |
| 3.1.14 | Site Regulations and Safety | 14 |
| 3.1.15 | Notices and Permits | 14 |
| 3.1.16 | Verification of Dimensions..... | 14 |
| 3.1.17 | Site to be Kept Tidy | 14 |
| 3.1.18 | Site Supervisors | 14 |
| 3.1.19 | Safety of Personnel | 14 |
| 3.1.20 | Packing and Transport Marking..... | 15 |
| 3.1.21 | Corrosion Protection and Painting..... | 15 |
| 3.1.22 | Maintenance Tools and Plant..... | 16 |
| 3.1.23 | Auxiliary Electrical Supply..... | 17 |
| 3.1.24 | Temporary Site Installation..... | 17 |
| 3.1.25 | Running Costs..... | 17 |
| 3.1.26 | Grounding/Earthing | 18 |
| 3.1.27 | Construction Specifications | 18 |
| 3.1.28 | Inspection and Testing | 19 |
| 3.2 | Energy Recovery System Plant | 23 |
| 3.2.1 | Scope of Work..... | 23 |
| 3.2.2 | RFP Required Submittals | 24 |

| | | |
|------------|------------------------------------|-----------|
| 3.2.3 | Project Submittals..... | 24 |
| 3.2.4 | Inspections and Training | 25 |
| 3.2.5 | Approved Suppliers | 26 |
| 4.0 | TECHNICAL DATA SHEETS | 26 |

LIST OF TABLES

| | | |
|-------------------|---|----|
| Table 3.1.8.1: | System Design Conditions..... | 10 |
| Table 3.1.26.2.1: | Required Plates for Each ERS | 17 |
| Table 3.1.29.7.1: | Tests at Manufacturer's Works | 23 |
| Table 4.0.1: | Existing Generator Description at Bagh-e-Pol DPP | 26 |
| Table 4.0 2: | Existing Generator Description at Breshna Kot DPP | 26 |
| Table 4.0 3: | Existing Generator Description at SIP DPP..... | 28 |

APPENDICES

- APPENDIX A - DPP Location Maps
- APPENDIX B - Specifications for Energy Recovery System
- APPENDIX C – Pricing Sheets (Section 4)

1.0 EXECUTIVE SUMMARY

Approach

This document provides a technical scope of work and conceptual design for the procurement of Energy Recovery Systems (ERS). The ERS will optimize the energy production efficiency of diesel generators located in the Kandahar area. Multiple diesel generators are needed to supply electricity to the area until the NEPS/SEPS transmission line connector can be constructed. This effort is expected to take several years. During that period, it is proposed to enhance the support generators to maintain the lowest cost of electrical power to the area.

Proposed is an ERS which consists of secondary turbines installed on select diesel generators exhaust systems. These small turbines rotate high speed permanent magnet generators (PMG) which produce additional electrical power, increasing the fuel efficiency by approximately 6%. Power produced by the PMG is electronically conditioned and injected into the power grid. The additional power generated can easily repay the program cost, and provide additional profit during the construction period of the NEPS-SEPS Connector system.

These facilities are to be developed as part of the initiative generally known as the Power Transmission Expansion and Connectivity (PTEC) program. This document has been prepared by Tetra Tech through the Afghanistan Engineering Support Program (AESP) sponsored by USAID.

This document provides a technical scope of work with supporting engineering documents, drawings and specifications that are intended to be incorporated into a request for proposals (RFP) to procure a complete and fully functioning Energy Recovery System, including design, and construction services. Sufficient information is provided for a supplier to execute final design and construct the complete ERS.

Findings

Specification Reviews

Previously issued RFP packages used successfully by DABS were provided to the project team as examples. The RFP examples used in the development of this technical specification document are as follows:

1. Design, Supply, and Installation for Kunduz – Taloqan 220kV Transmission Line Project Tender No. :DABS/001/ICB
2. RFP for Northeast Power System (NEPS) Electrical Transmission Projects, Afghanistan (US Army Corps of Engineers)
3. Asian Development Bank (ADB), Power Transmission and Distribution Project ADB Loan No. 2165-AFG(SF)/Grant 0004-AFG(SF); Supply, Delivery and Installation Contracts for Lots 1 & 2, Bidding Documents, June 2005
4. Engineering Study for 110 kV Transmission Line System Arghandi to Ghazni Final Report – Rev 7, March 14, 2013 for WO-LT-0048

Engineering Study

Conclusion

These technical documents provide a scope of work and conceptual design in sufficient detail to support a RFP for a supplier to provide and install ERS on selected Kandahar area diesel generators. Data supporting these technical documents was assembled from consultation with USACE, USAID, DABS and MEW. To the extent practicable, these technical documents have been structured to be compatible with the DABS Works RFP format.

Please note, that most of the diesel generators recommended for ERS enhancement will require a major rebuild/overhaul prior to the ERS modification. The overhaul program is NOT part of this RFP.

Kandahar Area Diesel Optimization

Therefore, it is strongly recommended that a parallel-path rebuild program be immediately developed and awarded. Application of the ERS enhancements is of little to no value on generators recording over 22,000 hours of operation without major overhaul.

Sections 2, 3, and 4 of this Report have been prepared to be used as the Section 6 of a DABS ICB Standard Works RFP format.

2.0 ACRONYMS

| | |
|----------------------|---|
| ACSR | Aluminium Conductor Steel Reinforcement |
| ADB | Asian development Bank |
| AFRM | Afghanistan Residence Mission |
| ANSI | Amercan National Standard institute |
| AP | Angle Point |
| ASCE | American Society of Civil Engineers |
| ASTM | American Society of Testing Materials |
| BDS | Bid Data Sheet |
| BOQ | Bill of Quantity |
| BK | Breshna Kot DPP |
| BP | Bagh-e-Pol DPP |
| BS | British Standard |
| Cct-km | Circuit Kilometer (Single Circuit, 3Phase, Single Conductor Per Phase) |
| COF | Contract Forms |
| CPA | Condtions of Particular Application |
| Cu.m, m ³ | Cubic Meters |
| DABS | Da Afghanistan Breshna Sherkat |
| DCPT | Dynamic Cone Penetration Test |
| DDP | Delivery Duty Paid |
| DDU | Deliver Duty Unpaid |
| deg | Degree |
| DIN | Deutsches Institute für Normung e.V. |
| DPP | Diesel Power Plant |
| DS | Direct selection |
| ELC | Eligible countries |
| ERS | Energy Revovery System |
| EQC | Evaluation and Qualification criteria |
| EXW | Ex factory, ex works or ex warehouse |
| FC | Foreign Currency |
| FIDIC | Federation Internationale des Ingenieurs Conseils (International Federation of Consulting Engineers) |
| FOB | Free on Board |
| g/m ² | Gram Per Meters Square |
| GCC | General Conditions of Contract |
| GFE | Government Furnished Equipment |
| ICC | International Chamber of Commerce |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| IFB | Invition for Bids |
| ISO | International Standards Organization |
| ITB | Instruction to Bidders |
| kg | Kilogram |
| kg/cm ² | Kilogram Centimeter Square |
| kN | Kilo Newton |

Kandahar Area Diesel Optimization

| | |
|------------------------|---|
| KV | Kilo Volt |
| l.m, m | Linear Meters, Meters |
| L.S | Lump Sum |
| LARP | Land Acquisition and Resettlement Plan |
| LC | Local Currency |
| LSIP | Little SIP DPP |
| m/sec | Meter per Second |
| MEW | Ministry of Energy and Water |
| MOSS | Minimum Operating Safety standards |
| N | Newton |
| No. | Number |
| NoC | Negotiation of Contract |
| N/mm ² | Newton per Milimeter Square |
| NTP | Notice To Proceed date (Award date of contract) |
| OPGW | Optical Fiber Ground Wire |
| Owner | DABS |
| Owners Engineer | DABS Appointed/Selected Technical Representative(s) |
| PCC | Plain Cement Concrete |
| PCU | Project Coordination Unit |
| PDF | Proposal Forms |
| PDS | Proposal Data Sheet |
| PISU | Programme Implementation Support Unit |
| PMG | Permanent Magnet Generator |
| PMO | Project Management Office |
| RCC | Reinforced Cement Concrete |
| RFP | Request for Proposal |
| RoW | Right of Way |
| SCADA | Supervisory Control and Data Acquisition |
| SCC | Special Conditions of Contract |
| SIP | Shorindam Industrial Park DPP |
| SMEC | Snowy Mountains Engineering Corporation |
| SPT | Standard Penetration Test |
| sq.m, m ² | Square Meters |
| sq.mm, mm ² | Square Milimeter |
| TIF | Telephone Influence Factor |
| Ton | Metric Ton |
| UN | United Nation |
| UNMACA | United Nations Mine Action Center, Afghanistan |
| UXO | Unexploded Ordinance |
| VDE | Verband Der Electrotechnik Elektronik Informationstechnik e.v |

3.0 TECHNICAL SPECIFICATION

3.1 PROJECT DESCRIPTION

3.1.1 Overview

The existing Northeast Power System (NEPS) is a 220 kV transmission system that extends power from Uzbekistan and Tajikistan south through the Salang Pass to the Pul-e-Khumri and Chimtala Substations in northern Afghanistan. Efforts are currently underway (by others) including the Asian Development Bank (ADB) to construct a new substation at Arghandi to extend the 220 kV transmission line system south from the Chimtala Substation to new substations in the south. A new substation in Ghazni will be fed from Arghandi via a new substation in Sayedabad. Approximately 405 km of 220 kV transmission lines will be built (by others) to route power from the Ghazni Substation to the Kandahar East Substation. At the Kandahar East Substation some of this power will be transitioned to 110kV, and becomes the main power source for the Kandahar area. The Connector is estimated to arrive in approximately four years.

This contract will procure, construct, and commission multiple ERS at multiple DPP sites. These DPP's must remain in constant operation until the above transmission system can supply electrical power to the area (estimated at 4 years). The project will apply advanced technical hardware to existing DPP engines to provide an optimized economic generating plant.

All equipment, materials, shipping, construction, and training necessary to complete the ERS shall be provided by the Contractor.

Project location maps of the three DPP can be found in Part 6.

The words "Employer" and "Engineer" as used in this document have their meaning as defined in the RFP.

3.1.2 Energy Recovery System

It is anticipated that the ERS shall be a self-contained, containerized system which will mount directly on top of the existing containerized diesel generators. Existing systems are built with dual exhaust stacks exiting container tops. The ERS will connect to these exhaust systems via ERS container floor entrances. Any modifications to existing plant equipment shall also be contractor supplied and installed. The bidder's attention is called to the distance between the top of the existing containerized diesel generators and the bottom of the roof above the container; See the photographs in Section 5.0

Each ERS shall be a system designed specifically for a given diesel generator location. The ERS design shall also include all human access hardware (such as stairs) for normal operation and maintenance purposes.

3.1.3 Coordination Activities

Contractor shall interface and coordinate with other parties to ensure proper installation and connection of ERS to existing plant systems. The interface point between existing plant and the ERS shall be the plant 400VAC power system. In all cases the Contractor shall coordinate with DABS site management prior to operation of any DPP equipment.

3.1.4 Code, Standards, Specifications

All material used, plant supplied, and all workmanship and tests shall be in accordance with the latest editions of IEC and ISO Standards. Where International Standards are not applicable, all shall be in accordance with national standards such as ASA, ANSI, ASTM, BS or VDE + DIN, IEEE, ASCE. Where such standards and codes are national or relate to a particular country or region, other

authoritative standards that ensure substantial equivalence to the standards and codes specified or in accordance with technical requirements of a Country where the site is located, will be acceptable. For any such standards which are not written in the English language, the Contractor shall make available copies of a certified English translation thereof.

Where no standards exist, as in the case of patent or special materials, all such materials and workmanship shall be of the best quality and full details of the material and any quality control tests to which they may be subjected shall be submitted to the Engineer for approval.

The Contractor shall deliver (soft copy and hard copy) at his own cost, one complete set of the selected and approved international code standards, and specifications to the Employer / Engineer within 28 days after commencement of the works. The set shall contain codes, standards and specifications as referred to in the technical specifications or approved alternatives. One set shall be kept at the Contractor's site office and shall be accessible to the Employer or his representatives during working hours.

3.1.5 Equipment and Materials

All equipment and materials to be incorporated in the works must be new, unused, and of the most recent or current models, and must incorporate all recent improvements in design and materials unless provided for otherwise in the Contract. All equipment and material shall be of design suitable for adverse climatic conditions as experienced on site in Afghanistan. All equipment and material shall be inspected and tested in full, to prove compliance with the requirements of the Specifications to the satisfaction of the Engineer.

3.1.6 Workmanship

All work, method statements of work and workmanship, whether fully specified herein or not, shall be of the highest order. In all respects, the generally accepted requirements and commonly recognized good practice for first-class work of this nature are to be adhered to and the Contractor shall submit quality certificates for materials. Method statements shall be submitted for all works for review and approval before the work commences and shall be to the satisfaction and approval of the Engineer.

3.1.7 Design and Engineering

The Contractor shall design, manufacture, supply, erect, construct, install, test and commission all equipment and materials, items and components of the Works, and carry out all installation services and work necessary so that the Works described herein shall be satisfactory for their intended purpose.

The Contractor shall design the complete Works in accordance with the design criteria and specifications given in the Supply Requirements, and as listed in Appendix B.

All design carried out by the Contractor shall comply with these Specifications and shall take into account all requirements of the Facilities and technical requirements of Afghanistan. The Contractor shall optimize the design of each component of the Works in order to achieve the most economic design. The Contractor shall be entirely responsible for all design carried out by the Contractor.

The Contractor shall inform themselves fully of the actual dimensions, levels, heights of roofs, etc., of any other existing or proposed structures before bidding and before commencing the manufacture of parts dependent on such data. The design calculations for each member forming part of the system shall be based on the most unfavorable combination of all the loads which the said member or part is intended to support or assist in supporting either permanently or temporarily. All design calculations shall be subject to the review and approval of the Engineer.

Where appropriate design criteria or specifications are not indicated in the supply requirements or shown in the Bid Drawings, then the Contractor shall carry out the design work in accordance with

generally accepted engineering design theories, principles and criteria, to the satisfaction of the Engineer.

The Contractor shall provide the Employer with fully detailed design drawings, detailed design reports and design calculations relating to the Works. All design work shall be subject to the approval of the Employer, pursuant to the Conditions of Contract. Design drawings, design reports and design calculations shall be prepared and submitted in accordance with chapter Documentation of the General Requirements.

3.1.8 System Characteristics and Climatic Conditions

All equipment and material shall be designed for efficient operation under Afghanistan's climatic conditions, which can be harsh with snow and ice in winter and hot and dusty conditions in the summer. The following system characteristics and climatic conditions data are provided for guidance in designing the equipment and related material:

Table .3.1.8.1: System Design Conditions

| Climatic and Geographic Conditions | |
|------------------------------------|--------------------------------|
| Altitude (Project Area only) | 1,000m to 2,500 meters |
| Dry Period | June to November |
| Rain Period | December to May |
| Annual Rainfall | 327mm |
| Air Temperatures: | |
| Average | 12°C |
| Maximum | 39°C |
| Minimum | -6.0°C |
| Average Humidity Summer | 35% |
| Average Humidity Winter | 75% |
| Wind: | |
| Maximum Wind Velocity | 41m/s (148km/h) |
| Wind and Dust | Sand and dust storms in summer |
| Isokeraunic Level Thunderstorm | 23 days/year |

3.1.9 Language

The English language shall be used in all Contract documents and in all correspondence between the Contractor and the Engineer, and between the Contractor and the Employer.

3.1.10 System of Units

In all correspondence, in all technical schedules and on all drawings, metric units of measurement, System International (SI) system of units, shall exclusively be used:

- Dimensions in meters and millimeters unless specified otherwise
- The unit of mass is the kilogram (kg)
- The unit of force is the Newton (N)
- Angular measurement shall be in degrees, with 90 degrees comprising one right angle

3.1.11 Documentation

3.1.11.1 General

The sizes of all documents and drawings shall conform to the ISO standard, and be of size A1, A2, A3, or A4. Larger sizes than A1 shall be avoided. All documents in size A3 and A4 shall be bound with front and back covers. The schematic diagrams, apparatus, and cable lists shall be produced in size A3 or A4. The Contractor shall submit the hard copy and soft copy of all documents as per the specification and price schedule.

All drawings shall be prepared and submitted in the latest version of AutoCAD or a similar computer aided drafting software package acceptable to the Employer. Scales to be used on the drawings shall be 1:10, 1:20, 1:40, 1:50 and multiples of this series.

Operational and warning labels shall be in English and Afghan languages.

The Contractor shall, during the project duration, maintain a List of Documentation to be updated whenever needed. The List of Documentation shall include the date of the original issue of each document submitted as well as the dates of every revision. The List of Documentation shall also include a time schedule for the submittal of the documentation.

3.1.11.2 Documentation for Design and Manufacture

During the design period, full documentation on all plant equipment shall be supplied to the Engineer and to the Employer for review and approval. All drawings prepared by the Contractor shall be submitted per the requirements listed later in this document. All documentation shall have such information or instructions related to the drawings and the design as may be necessary.

Within twenty eight (28) days after receiving such drawings, calculations, samples, patterns and models, one copy of each document will be returned to the Contractor, dated, signed and marked by the Engineer and, where necessary, with proposed corrections indicated.

Any delay arising out of failure by the Contractor to rectify the design, calculations, drawings, etc. in a reasonable time frame should not alter the Contract completion date.

Drawings marked **RETURNED FOR CORRECTION** shall be corrected by the Contractor and sent to the Engineer for further review.

When a drawing is marked **REVIEWED** or **REVIEWED AS AMENDED**, the Contractor will be allowed to use the drawing for manufacture and erection. The Contractor shall, however, make corrections according to the remarks given by the Employer, Engineer, expert and upon their approval, the Contractor may use the drawings. Manufacturing starting prior to receipt of drawings marked **REVIEWED** or **REVIEWED AS AMENDED** is done at the Contractor's own risk.

The Engineer's approval does not, however, in any way relieve the Contractor of his full responsibility for the correctness of his documentation and the proper functioning, quality and compliance with the Specifications of all plant and equipment supplied by him.

The Engineer's approval shall not relieve the Contractor from full responsibility from mistakes or omissions therein or there from (including any resultant mistake or error in the Works) or for any discrepancy or deviation from the Technical Specification and other drawings.

Calculations, samples, patterns, models, etc., submitted to the Engineer for his review, shall be such as are called for herein or as may be necessary for proving compliance with the Contract.

3.1.11.3 Documentation for Installation

The Contract Price shall be deemed to include illustrated installation, operating, service and maintenance instructions for the Works, which shall be written in English. The installation, operation, service, and maintenance manuals shall cover all aspects of the Works, including the civil works and structures, water drainage and under-structure drainage, etc., and all electrical

equipment supplied. Hard copy and soft copies of the Method Statement with drawings/sketches shall be submitted for review and approval to the Employer/Engineer for construction, erection, installation, etc. works.

The manuals shall include parts catalogues, and details of equipment installation, operation, maintenance, and repair. If the manufacturer's standard bulletins are supplied, they shall be clearly marked to indicate the specifications applicable to the particular equipment that is supplied. Each manual shall include a full set of assembly drawings, including wiring diagrams, reduced to A3 size. The manual shall also contain a detailed service program adapted for each plant for all equipment explaining what action shall be done on which equipment and when.

Prior to the installation period the Contractor shall distribute copies of the REVIEWED documents and such other particulars, to the Employer in four (4) sets and to the Engineer in one (1) set.

The Contractor shall submit in due time but not less than one month before commissioning, two copies of preliminary Operation and Maintenance Instructions and Service handbooks to the Engineer for review and approval, following the same procedure as for the drawings.

The approved documentation shall be distributed in five (5) sets to the Employer two months before the start of commissioning.

If any descriptive brochures forming part of this documentation shall be provided in English versions, complete translations shall be enclosed.

The documentation shall continuously be updated during the installation and test period by the Contractor. During the initial period of operation and before receipt of as-built documentation at the site, one copy of the updated erection documentation, instructions, etc., shall be kept at the site.

3.1.11.4 Commissioning and Completion Report

Prior to the issue of the Taking-Over Certificate, the Contractor shall submit to the Employer's Representative one original and six copies of a Commissioning and Completion Report for each Section of the Works. The Works, or, if applicable, the Section, shall not be considered to be completed for the purposes of taking-over until such Commissioning and Completion Reports have been submitted to the Employer's Representative.

3.1.11.5 As-Built Documentation

General

Immediately after the Operational Acceptance of the Facilities, the Contractor shall update all final documents in accordance with the modifications made. When a document contains all modifications, it shall be marked As-built.

As-built documentation shall be submitted to the Employer in four (4) sets and to the Engineer in one set, within two months of Operational Acceptance of the Facilities.

For drawings A3 size and larger, one of the sets issued to the Employer, shall be of reproducible transparent material (PVC). In addition two soft copies, CD ROMS or similar computer storage media, shall be supplied for all As-Built drawings.

The supply of As-built documents shall comprise but not be limited to all AutoCAD drawings for construction and installation, calculations, instructions for operation, maintenance, repair and adjustment, apparatus lists, spare parts lists containing information needed for ordering for all equipment supplied under the Contract.

General Manuals

The following general manuals, covering the whole project, shall be delivered:

- A general description of the equipment in this contract
- Operating instructions, suitable for training of personnel

- General maintenance instructions, describing frequencies and methods for regular inspections, for planned maintenance and for regular part replacements. The instructions shall also include fault location guides.
- The manuals shall include spare part lists and description of any special tools needed for service of the equipment.
- All other drawings or manuals that are not mentioned, but are deemed necessary for a safe and proper handling of the delivered equipment.

System Design Documentation

The following documents shall be delivered:

- All layouts, construction and installation drawings
- All design calculations, regarding civil, electrical, and mechanical design data and computations
- Design Drawings, ERS layout and installation.

System Documentation

Documents for approval shall be delivered prior to commencement of work and shall also be included in the as-built documentation as follows; in case of alterations agreed upon by all parties, new documents shall be issued:

- Type test certificates for important equipment and material: data specifications on other equipment
- Routine test certificates
- Data lists with Engineer required amendments incorporated. The contents of the lists shall correspond to the schedules of this document. Data lists will be regarded as binding for the manufacturer
- Dimension drawings. They shall be regarded as binding for the manufacturer and shall contain measures, weights and features of the equipment
- Detail drawings as required by the Engineer

3.1.12 Progress Reports

Work plans, monthly programs, and reports shall be provided by the Contractor. At the end of each month, the Contractor shall submit suitable written progress reports to the Employer and Engineer with the progress of design, manufacture, delivery, transport, erection, etc. A proposed timeline schedule will be provided. If the progress of the Works does not conform to the approved Program, the Contractor shall indicate these deviations, with substantiating reasons.

3.1.13 Manufacture

Before commencing any manufacture of the equipment and structures, the Contractor shall submit for the approval of the Engineer, the drawings of the manufacturers of the equipment and structures. After such approval has been given, the manufacture shall be planned and performed according to the Specifications and to the satisfaction of the Engineer.

The Engineer shall be afforded every opportunity to control and inspect the manufacture and testing of materials in the steelworks, rolling mills, foundries, factories etc., and their assembly in the workshops of the Contractor and his Subcontractors.

3.1.14 Site Regulations and Safety

The Employer and the Contractor shall establish Site regulations according to the General Conditions of Contract.

The Contractor shall provide appropriate training in handling plant and machinery to the workers and laborers before the commencement of work. All workers employed by the Contractor shall be insured against any accident.

3.1.15 Notices and Permits

The Contractor shall give the requisite notice and obtain any necessary approvals from the Site Management, Government, or Authorities. Authorities' Inspectors may be required in the case of excavations, trenching and (in particular) blasting operations. The Contractor shall pay for all permits required prior to and during the execution of the Contract, including those required for all temporary works.

3.1.16 Verification of Dimensions

Before work is commenced on any structural element required to be fabricated, or provided under this Contract, the Contractor shall verify by measurement on site, the relevant dimensions of all work previously completed.

3.1.17 Site to be Kept Tidy

Throughout the progress of the Works, the Contractor shall keep the site and all working areas in a tidy and workmanlike condition, and free from rubbish and waste materials. Other items, which are not required for use by the Contractor at the present time, shall be dispersed about the site in an orderly fashion, or shall be properly and securely stored.

The Contractor shall not mobilize or demobilize any construction plant, materials, etc. from the site without the approval of the Employer or Engineer.

3.1.18 Site Supervisors

The Contractor shall provide the services of competent specialists to supervise the construction of the Works and installation of Plant at the Site. The Contractor's Site Supervisors shall be given full responsibility and authority to negotiate and agree to points arising out of the Works, in order that the Works may proceed with a minimum of delay.

Directions and instructions given by the Employer or the Engineer to the Site Supervisors shall be interpreted as having been given to the Contractor.

3.1.19 Safety of Personnel

The maximum safety, consistent with good erection/installation practices, shall be afforded to personnel directly engaged on this Contract, or to persons who, in the normal course of their occupation, find it necessary to utilize temporary works erected by the Contractor to access the working area.

Once any section of the Works or Plant has been energized, the Contractor shall establish a system for ensuring the safety of personnel and plant. While the Works and Plant are under the control of the Contractor, the Contractor shall be primarily responsible for the safety precautions. While the Works and Plant are under the control of the Employer, the Employer shall be primarily responsible for these precautions.

3.1.20 Packing and Transport Marking

All parts of the ERS Plant shall be well packed and protected against loss or damage during the transport by sea and land and whilst in storage under adverse climatic conditions. All packing shall be performed in such a way that the plant will not be damaged by overturning of the packages or by weather. Dimensions of packages, crates, etc., shall be suitable for road transport. Instructions for handling shall be clearly marked on all parts, packages, and crates.

All parts, packages, and crates shall be adequately marked to enable identification. Each item contained in a package shall be clearly identified on the packing list by its description and part number and assembly drawing reference, and each item shall be marked or labeled to correspond with the packing list. The marking system to be used shall be as instructed by the Engineer.

All packages shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked with signs showing 'up' and 'down' on the sides of boxes, and handling and unpacking instructions as considered necessary. Special precautions shall be taken to prevent rusting of steel and iron parts during transit by sea or storage on land.

The cost of all plant needed for the temporary fixing and supporting of the various parts of the Plant and the various packages to crane hooks, etc., during handling, transport and storage and the cost of load distribution beams, etc., where they form part of the packing or crates, shall be included in the Contract Price.

The Contractor shall be entirely responsible for all packing, and any loss or damage shall be rectified by the Contractor and, except where otherwise provided, at the Contractor's own expense. This paragraph also applies to all GFE after hand-over to the Contractor.

Identification, reinforcement, or upgrading of roads/bridges for access to the site and for transport of plant and materials shall be the responsibility of the Contractor. Any costs associated with identification, reinforcement and upgrading of roads and bridges shall be deemed to be included in the Contract Price.

3.1.21 Corrosion Protection and Painting

3.1.21.1 General

All parts of the Plant shall be protected against corrosion under service conditions. The protection shall also prevent corrosion during transport and storage. Because of the high humidity at the Site, the protection shall be carried out at the Contractor's workshop.

Damage to the protection during transport, erection, etc., shall be repaired to the same quality as specified for the plant item.

3.1.21.2 Surface Protection

All steel and iron surfaces to be painted shall be cleaned of oil and grease. The surfaces shall be of clean metal and shall be dry and free from any foreign matter at the time of painting.

All surfaces to be painted shall be smooth, even and free from dirt, rubbish and shall be dry and protected from dampness; i.e., surfaces shall be free from anything that will adversely affect the adhesion or appearance of paint or galvanizing.

The Contractor shall inform the Engineer in good time before starting to apply the next coat so that the Engineer shall have the opportunity of approving the previous coat. Painting systems shall not be carried out at temperature below 5°C or above 35°C. Trial coats shall be prepared at the request of the Engineer. The Contractor shall, upon completion remove all paint where it has been spilled, splashed, or spattered on surfaces including sanitary fixtures, glass, and hardware. It shall be removed without marring the surface finish of the item being cleaned.

All defective concrete/cement plaster shall be cut out and trimmed, holes in internal plaster faces shall be corrected with approved material. All dirt and powdery substrate shall be removed with slightly damp cloth.

All laitance shall be removed from concrete surfaces by wire brush or blasting. All holes and defects shall be filled and repaired by epoxy grouts. All dust and/or mill scale etc. shall, if necessary, be removed from new metal surfaces with a wire brush, chipping hammer or grinding. The surface of the metal work shall then be primed with an approved metal primer before application of the undercoat.

Pre-treatment of the galvanized surfaces includes etch-cleaning, sweep blasting (preferred) or emery paper used to clean and roughen the surface, remove any matter detrimental to the adhesion and to achieve a better anchor pattern.

Wood surfaces shall have all ironwork removed prior to the preparation of surfaces and re-fixed upon completion of the paint. All knots and resinous parts in wood surfaces shall be treated by two coats of shellac varnish. Cracks and holes shall be filled with approved filler and coated with one coat of primer.

3.1.21.3 Galvanizing

All ferrous parts shall be galvanized except where otherwise specified.

Galvanizing material shall be not less than 98% pure Zinc. The galvanizing procedure shall be started only after all chipping, trimming, fitting, and bending have been completed. Also, all drilling, punching, cutting, and welding shall have been completed and all burrs removed prior to galvanizing.

All steel, including bolts, nuts and washers shall conform to ASTM A-123, minimum thickness grade 85 and higher (see table 2, ASTM A 123-89a).

The zinc coating shall meet the requirements according to BS 729, ASTM, A123, A153, A239 and A385, DIN 50961, 50976, 50978 or other equivalent methods and international standards. All steel shall be fully fabricated before galvanizing. No machine or shop work, boring, punching, etc., will be allowed after galvanizing.

3.1.22 Maintenance Tools and Plant

The Contractor shall include and supply all tools and plant with latest calibration certifications that are required for the normal operation and maintenance of the equipment being supplied under the Contract. All tools and plant shall be subject to the inspections and/or tests on the functions specified in the Supply Requirements and guaranteed in the approved drawings.

Instruction manuals of tools and plant shall be submitted for approval in the same manner as the installation operation and maintenance manuals and when finally approved, one original and three copies shall be prepared and forwarded to the Employer.

Each tool and plant item shall be clearly marked with its size and/or purpose and shall be packed in the appropriate box with three (3) sets of an operation and maintenance instruction book. All nameplates, duty labels, and instruction plates on tools and appliances shall be marked in English.

3.1.23 Auxiliary Electrical Supply

The Contractor shall be entirely responsible for providing auxiliary electricity supplies needed on Site for construction and commissioning.

3.1.24 Temporary Site Installation

The Contractor shall be entirely responsible for providing all temporary site installations of every kind that may be required for carrying out the works including the facilities for offices, living accommodations, fenced storage areas, lockable sheds, installations for supply of industrial water, power and compressed air, etc. The Contractor shall plan all temporary site installations required for the works and obtain the approval of the Engineer. After completion of the work, such temporary installations are to be removed and the site left clean.

All costs for the construction and/or supervision and the removal or handing over to the Employer of all temporary site installations shall be deemed to have been included in the price schedules.

3.1.25 Running Costs

The Contractor shall be entirely responsible for the running and maintenance costs throughout the period when the site works are being carried out, including all temporary site installation works.

The costs for running and maintaining the temporary site installations together with other running costs necessary for the satisfactory execution of the works shall be deemed to have been included in the price schedules.

3.1.25.1 Workmanship

All work shall be equal to the best modern practice in the manufacture and fabrication of materials covered by this Specification.

The Contractor shall be responsible for the correct fitting of all parts. The Contractor shall replace, free of cost, any defective material discovered during erection, and pay all costs of field corrections for such replacement.

All parts of the ERS shall be neatly finished and free from kinks, twists, or bends. The fabrication shall be in strict accordance with the shop drawings prepared by the Contractor and approved by the Employer.

Structural material shall be straight and cleaned of all rust and dirt before being laid out or worked in any manner. Shearing and cutting shall be performed carefully. Manually guided cutting torches shall not be used.

All bolt holes in steel members shall be punched, sub-punched, reamed or drilled before galvanizing. All holes shall be cylindrical and perpendicular to the member, clean cut with sharp tools and without torn or ragged edges.

Plugging, welding, or slotting of miss-punched, miss-reamed or miss-drilled holes will not be permitted. The holes shall be located accurately so that when the members are in the correct position the holes will be lined up before being bolted.

3.1.25.2 Identification Plates

Table 3.1.26.2.1: Required Plates for Each ERS

| Plate Type | Quantity / ERS |
|--------------------------|--|
| Manufacturer's Nameplate | 1 |
| Danger signs | 1 (more if required per site installation) |

| | |
|---|---|
| ERS number plate | 1 |
| (related) Diesel Generator ID number plates | 1 |

Danger plates shall feature red symbols on a white background. They shall comprise a skull with crossed bones, as well as lightning arrows conforming to DIN 40006. The text "DANGER" and line voltage shall be boldly written in both Dari and English languages.

ERS number plates shall show the ERS number in black letters, on a white background. The height of the letters shall not be less than 150mm.

The danger signs and the ERS number plate shall be installed on the ERS container base at a height of approximately 1.5m above the floor. The number plate shall face the normal ERS access.

All plates shall be of corrosion resistant aluminum with embossed letters and painted, or of enameled steel. If enameled steel is used, great care shall be taken to ensure that the surface is completely enameled (including edges) and not damaged during transport and installation. In this case, special washers of an approved material shall be provided to provide protection of the enamel surfaces where nuts and bolts are to be secured.

On all plates, the colors shall be free from fading. Lettering and size of the plates shall be approved by the Employer.

3.1.26 Grounding/Earthing

3.1.26.1 General

Every structure shall be permanently and effectively grounded to achieve a low resistance.

3.1.26.2 Connections

The ground wire shall be directly connected to the ERS with bolted connectors of an approved material suitable for use with the ground wire such that galvanic action (i.e., chemical reaction between copper and galvanized steel) is minimized.

Connections to the DPP earthing grid shall be made by exothermic weld, compressed clamps or bolted connectors of approved design.

Connections to the ERS container and internal equipment shall not be made over painted surfaces. All such required connection points shall have existing paint removed (in the connection area) prior to the application of ground lug. After certification of ground resistance, the painted area about the connection shall be properly touched up per Section 3.1.21.

3.1.27 Construction Specifications

Calibration of Plant

The Contractor shall ensure that all plant/instruments are properly calibrated and approved laboratory test certificates shall be submitted to the Employer. If the Employer desires to witness such tests, the Contractor shall arrange for the same at his cost.

3.1.27.1 Measurement of Ground Connection Resistance

The Contractor is required to perform ground resistance tests at every ERS ground cable connection point. Method of measurement, tools and instruments shall be submitted to the Employer/Engineer for approval.

The Contractor shall be responsible for all tests. The maximum ground connection resistance between existing DPP counterpoise and grounded ERS part shall be 50 micro-Ohms. The data shall be prepared in an approved form and submitted to the Employer.

Surplus Material

All material surpluses to the requirement of fill and all debris and rubbish shall be removed and deposited as directed by the Employer.

3.1.27.2 Spare Parts and Tools**Spare Parts and Tools**

In the schedule of prices, spare parts and tools are listed. These parts must not be used for erection or installation, except as agreed by the Employer.

Should the Bidder consider additional recommended spare parts advisable, these parts with separate prices are to be quoted in the price schedule.

The spare parts and tools shall be delivered to the Employer's stores as directed by the Employer. The spare parts and tools listed in the price schedule are calculated to be sufficient for the five year operation of the transmission lines.

The Employer shall have the right to increase or decrease by 100%, or delete all items of specified spare parts and tools within the contract completion time, without penalty to the Employer.

In case of any changes in specified quantities, the price for specified spare and tools shall be adjusted by applying the contract unit rates.

3.1.28 Inspection and Testing**3.1.28.1 Scope**

The whole of the works supplied under the Contract shall be subject to inspection and testing by the Employer or their representative during manufacture, erection, and after completion. The inspection and tests shall include, but not be limited to, the requirements of the Specification.

All plant, supervision, labor, and services necessary to carry out all tests shall be provided by the Contractor unless specifically stated otherwise.

All expenses related to the factory tests of ERS shall be borne by the Contractor.

3.1.28.2 Quality, Assurance, Inspection, and Testing

To ensure that the supply and services under the scope of this Contract whether manufactured or performed within the Contractor's works or at his subcontractor's premises or at the site or at any other place of work are in accordance with the Specifications, the Contractor shall adopt a suitable quality assurance program to control such activities at all points necessary. Such a program shall be outlined by the Contractor and shall be accepted by the Employer after discussion and before the award of Contract. A quality assurance program of the Contractor shall generally cover, but not be limited to the following:

- Contractor's organization structure for the management and implementation of the proposed quality assurance program
- Documentation Control System
- Qualification data of Contractor's key personnel
- The procedure for purchase of plant, materials, parts, components, and selection of subcontractors' services including vendor analysis, source inspection, incoming raw materials inspection, verification of material purchases
- System of shop manufacturing including process controls and fabrication and assembly controls
- Control of non-confirming items and system for corrective actions

- Control of calibration and testing of measuring and testing plant
- Inspection and test procedures for manufacturer
- System for indication and appraisal of inspection status
- System of quality audits
- System of authorizing release of manufactured products to the Employer
- System for maintenance of records
- A quality plan detailing specific quality control procedures adopted for controlling the quality characteristics relevant to each item of supply

The quality plan shall be mutually discussed and approved by the Employer after incorporating necessary corrections by the Contractor as may be required.

Quality Assurance Document

The Contractor shall be required to submit all Quality Assurance Documents as stipulated in the Quality Plan at the time of Employer's inspection of plant.

The Employer through his duly authorized representatives, reserves the right to perform Quality Audits and Quality Surveillance of the systems and procedures of the Contractor's and sub-contractor's Quality Management and Control Activities.

3.1.28.3 Inspection, Testing, and Inspection Certificates

The provision of the clauses on Test and Inspection of the General Conditions of Contract and Special Conditions of Contract shall be applicable to the Supply and Erection portions of the Works. The Employer shall have the right to re-inspect, at his expense, any material even though previously inspected and approved by him at the Contractor's works, before and after the same are inspected at site. If during the re-inspection, the material is found to be defective, the Contractor shall bear the cost of this inspection and reinstatement according to specification.

The Engineer and/or Owner shall be allowed to witness testing performed by the Seller, as well as inspect the equipment at any time. Inspection by the Engineer/Owner shall not relieve the Seller of his responsibility to inspect the equipment, confirm all requirements of testing, and supply complete equipment which satisfies all requirements of these Specifications.

Guarantees

Bidders shall state and guarantee the technical data sheet and guarantee, forming a part of the other sections of the bid document. These guarantees shall be binding and shall not be departed from without the written permission of the Employer. The tolerance specified in the IEC, BS, ISO or ANSI Standards shall apply, unless stated otherwise.

3.1.28.4 Pre-Design Tests

The Employer realizes that optimization of the DPP may require some initial field testing to determine exactly what existing components should be upgraded for operation with the ERS enhancements. Therefore, the Contractor is allowed initial access and testing at Bagh-e-Pol DPP (1600kW CAT engines) and SIP DPP (1525 kW MTU engines). Up to 7 days of testing per engine type will be allowed.

All tests shall be fully coordinated with site management. The Contractor shall be responsible for all test equipment and costs.

3.1.28.5 Tests at Manufacturer's Works

Where no specific test protocol is specified, then the various items of plant shall be tested in accordance with the BS, IEC, DIN, ANSI, ASTM Standards, or any recognized International Standards.

No plant shall be packed, prepared for shipment, or dismantled for the purpose of packing for shipment, unless it has been inspected or inspection has been waived by the Employer.

All instruments and plant used in the performance of tests shall be approved by the Employer and if required by the Employer, shall be calibrated to an agreed standard at a laboratory of national standing to be nominated by the Contractor and approved by the Employer/Engineer.

The cost of carrying out calibrations shall be borne by the Contractor in all cases.

Within 15 days of the completion of any test, a triplicate set of all principal test records, test certificates and performance curves shall be supplied to the Employer/Engineer.

3.1.28.6 Field Acceptance Tests**Measurement of Footing Resistances**

Before installation of plant equipment, the footing resistance of each ERS mounting footer shall be measured with an earth resistance measuring instrument to the approval of the Employer.

Measurement of Earth Electrode (Counterpoise) Resistance

Where the footing resistance is found to exceed 10 ohms, additional earth electrodes (or counterpoises) shall be installed and the combined earth electrode and footing resistance measured together and recorded using the same test instrument. Additional electrodes are to be installed until a maximum resistance value of less than 10 ohms has been achieved.

Measurement of Galvanizing Thickness

The Contractor shall have available on Site for the Employer's use, an instrument suitable for the accurate checking of galvanizing thickness. The gauge shall be available from the time of arrival of the first consignment of steel work until the issue of the Operational Acceptance Certificate. The cost of the gauge and other operating expenses are deemed to be included in the Contract Price and the gauge will remain the property of the Employer.

Tests prior to ERS Installation

All tests shall be carried out on site by the Contractor.

Each diesel generator to be enhanced shall be fuel efficiency tested prior to enhancements. The generator shall be operated (into a contractor supplied load bank) at 90-100% of rated kW load. A measurement of fuel consumption shall be taken.

3.1.28.7 DPP Site Acceptance Tests (after Enhancements)

The Manufacturer shall submit a "Field Acceptance Test Procedure" document for approval at least six (6) weeks prior to expected formal Field Acceptance Testing. The document shall, as a minimum, detail step-by-step procedures to demonstrate complete and proper operation of the system. It shall also document all test equipment to be used, including their calibration date. Only equipment with certified calibration labels showing proper calibration performed within the last 12 months shall be used. The Manufacturer shall provide all necessary equipment for all tests. Equipment panel meters shall not be used in lieu of external test equipment.

After full field installation on a diesel generator, each ERS installation shall be tested by manufacturer's technicians (typical manufacturer's tests may be utilized) to assure proper operation. Upon satisfactory testing, the system shall undergo any additional field tests per the approved Field Acceptance Test Procedure.

The Engineer and/or Owner shall be required to witness testing performed by the Seller. Inspection by the Engineer / Owner shall not relieve the Seller of his responsibility to inspect the equipment, confirm all requirements of testing, and supply complete equipment which satisfies all requirements of these Specifications. It is the responsibility of the Supplier to notify the Employer of proposed test dates at least 7 calendar days in advance of such testing.

Any changes/calibrations/repairs required during the Field Acceptance Test Procedure shall require a re-start of the entire Field Acceptance Test Procedure. Acceptance of the equipment shall not occur until all parts of the Field Acceptance Test Procedure have been successfully demonstrated to the satisfaction of the Engineer and/or Owner, and all documents have been signed by all parties.

Testing shall include, as a minimum:

- All supplier/manufacture site tests recommended to assure proper performance under normal and emergency operating conditions.
- Each diesel generator shall be fuel efficiency tested after enhancements, and successful testing above. The generator shall be operated (into a contractor supplied load bank) at 90-100% of rated kW load (as close to pre-enhancement conditions as possible). Total load shall include power from the ERS generation system. A measurement of fuel consumption shall be taken. The system shall not be acceptable until a minimum decrease in fuel consumption of 5% is obtained. The contractor shall be fully responsible to demonstrate this level of consumption.

Test Instruments

The method of measuring all quantities and qualities and the measurement tolerances shall be in accordance with the appropriate BS, IEC, ISO or ANSI Standards.

The test instruments required for establishing that guarantees are met shall be precision test instruments installed by the Contractor in addition to the permanent instruments where supplied under the Contract. The overall design of the Works shall provide for the installation and use of test instruments so as not to interface with the plant loading or delay the guaranteed completion dates.

All of the precision test plant to be used for tests shall be calibrated against standard instruments before the tests and, if required by the Employer, also after the tests. Calibration certificates shall be available for inspection by the Employer or his representative.

During the design stage of the plant, the Contractor shall give details of measurements to be made to substantiate that the performance of the plant meets the requirements of the specification and in particular shall submit for approval a schedule of performance test instructions necessary to demonstrate the guarantees.

Test Reports

For each of the specified tests, the Contractor shall receive concurrence from the Employer regarding the test values. Contractor shall submit for review and approval triplicate copies of the test reports containing a complete analysis of the test results within 15 calendar days of the completion of the relevant tests for approval. Five (5) copies of the final fully approved report shall be submitted to the Employer.

Field Test Quality Plan

The Contractor shall develop a field test quality plan so that test results can be recorded accurately.

Cost of Tests at Manufacturer's Works

All cost related to any tests to be performed at the manufacturer's works, site and elsewhere for testing and witnessing by the Employer shall be borne by the Contractor.

This cost shall include furnishing plant, construction, erection, testing, visas and travel documents, airfares, ground transportation, acceptable accommodation, meals, daily allowance (@\$150/day/person cash in advance), etc.

After receiving the prior information about the completion of manufacturing at the factory, the Employer will depute his personnel to the Contractor's factory to witness the fabrication, assembly, and testing of any or all parts of major plant. The number of Employer's and Engineer's personnel and plant to be witnessed shall be as listed below. The frequency of such visits shall be as per inspection/testing requirements.

Table 3.1.29.7.1: Tests at Manufacturer's Works

| Type of Test | Visitors/Person | No. of Visits |
|------------------------------------|---------------------------|---------------|
| Mechanical Systems | Employer (4)+Engineer (1) | One (1) Visit |
| Electrical Control & Power Systems | Employer (4)+Engineer (1) | One (1) Visit |
| Emergency & Alarm Systems | Employer (4)+Engineer (1) | One (1) Visit |

If the Employer requests another test inspection after a successful test, the travelling expenses of the inspectors nominated by the Employer will be borne by Employer.

However, the Contractor shall bear all expenses incurred due to the repetition of any test due to:

- Failure of the first test
- Test facility not ready at the time of inspection or mismatch of test schedule/program provided by the Contractor

3.2 ENERGY RECOVERY SYSTEM PLANT

The ERS equipment to produce utility electrical power, needs to be designed and procured for installation and satisfactory operation outdoors under the conditions set forth in this document. The equipment is to be furnished complete, installed, and tested. The minimum fuel savings expected is 4% at constant load, with goals of 6% or greater. Higher efficiency systems will be given some preference in the RFP selection process.

The qualified Bidders should highlight the reliability of their system by presenting examples of successful experience on past or existing installations and operations of their system along with satisfactory customer references.

The equipment shall be furnished in accordance with this section. The manufacturer shall provide a standard design for the items within the scope of the specification. All materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of the product and shall be in accordance with accepted industry practices for energy recovery systems.

The requirements of the ERS equipment Specification Tables of Part 4 shall govern should conflicts occur between them and the written text of these specifications.

All equipment under these specifications shall be manufactured in accordance with the latest editions of all applicable codes and standards of IEC-EN or ANSI/IEEE, ANSI, ASTM, NEMA organization standards and all other applicable codes and standards. Manufacturers may choose to consistently follow IEC or ANSI/IEEE standards based on the manufacturer's usual compliance ratings. Specific standard references from one organization may be substituted by an equivalent standard from another organization for consistency of the manufacturer's compliance ratings. For example, an IEEE standard reference may be substituted by an equivalent IEC standard reference.

3.2.1 Scope of Work

The successful bidder shall design, procure, deliver, install, and test the complete proposed system for the Energy Recovery System at the Bag-e-Pol and Breshna Kot power generation plants, and converting it into useful 50Hz utility electrical energy. This co-generated electrical power should then be stepped up and synchronized with the local AC power bus before injecting it into the power grid. Furthermore,

it will be the responsibility of bidder to integrate all the pertinent meters, electrical protection and other miscellaneous equipment required for the proper, reliable and safe functioning of the proposed system.

The following aspects should be the main criteria for the equipment selection and award of contract:

- Performance in terms of net power produced
- Ease of installation
- Modularity
- Reliability and ease of maintenance
- Footprint (space required)
- Weight
- System complexity
- Suppliers QA QC program

The ERS equipment shall be suitable for operation at the altitude specified in Specification Tables.

The ERS equipment shall be designed and fabricated in accordance with the latest revisions of the applicable codes and standards.

The ERS equipment shall be furnished with all field connection hardware for field mounting on supports described in these specifications. All hardware shall be hot-dip galvanized.

3.2.2 RFP Required Submittals

Bidder will supply with his bid approximate gross weights, together with the overall physical dimensions of equipment of subassembly as packed for shipment, and a written proposal describing, briefly, the design, contents and number of shipping units.

The manufacture shall supply the following preliminary drawings, catalogs, details, reports, specifications, schedules, cost reports and constrains for the acceptance of the RFP design:

- a) Percent fuel savings claimed (based on total kW loads remaining constant)
- b) Mass and energy balance calculations supporting the ERS performance
- c) Equipment cut sheets and catalogs
- d) Layout of the equipment
- e) Interfaces generic diagram
- f) Main equipment specifications
- g) Delivery time schedule
- h) Implementation schedule
- i) A brief report on how the installation will be done, an estimate of the timing involved and the likely limits or constraints inherent to their systems (in terms of space, material needed) involved

3.2.3 Project Submittals

During the enhancement program, the following submittals are required. Each submittal is required not later than the dates listed (days are based on calendar days, 7 days/week). The manufacture shall supply the following preliminary drawings, catalogs, details, reports, specifications, schedules, cost reports and constrains for the acceptance of the preliminary design:

- a) Outdoor instrumentation equipment control wiring termination blocks [NTP+45]

- b) Equipment cut sheets and catalogs [NTP+30]
- c) Detailed layout of the equipment [NTP+45]
- d) Design parameters and description of the main elements [NTP+45]
- f) P&ID (Piping and Instrumentation Diagram) [NTP+60]
- g) Detailed interfaces generic diagram [NTP+60]
- h) Full main equipment specifications [NTP+60]
- i) Detailed delivery time schedule [NTP+60]
- j) Detailed implementation schedule [NTP+60]
- k) Field Acceptance Test Procedure document [NTP+60]
- l) Maintenance schedule highlighting the following: [NTP+80]
 - Frequency of minor and major maintenance operations with details about generators shutdown requirements.
 - Estimated labor required (in hours) for each task.
 - Fluids required (oil, coolants, water...) with associated specs and estimated annual volume.
 - Frequency of parts replacement (spares).
 - The technical profile of people required to ensure the proper use and maintenance aspects of the system.
- m) Cost reports [NTP+120]
 - Overall complete implementation costs, per unit (if relevant) and/or overall.
 - Detail of operating costs, per unit (if relevant) and/or overall, including at least
 1. Maintenance costs over 5 years
 2. Spare parts costs (any items above basic items already purchased)
- n) Generated power reports (on enhanced DPP completed to-date [NTP+180])
 - Gross generated power (kW), per generator and/or overall for site.
 - Net generated power(kW), per generator and/or overall for site(Taking into account any auxiliary, ancillary equipment)

3.2.4 Inspections and Training

The Engineer and/or Owner shall be allowed to witness all testing performed by the Seller, as well as inspect the equipment at any time. Inspection by the Engineer / Owner shall not relieve the Seller of his responsibility to inspect the equipment, confirm all requirements of testing, and supply complete equipment which satisfies all requirements of these Specifications.

The successful bidder will also be responsible for the training of local operators (up to 4 teams, 4 persons per team) on how to operate and maintain the system. This should include but not limited to how local operators of the system can “bypass” or shutdown the proposed system and be able to use the generators in case of a system failure (or maintenance requirements for the proposed system). Training shall also cover typical maintenance procedures and troubleshooting of failed systems.

3.2.5 Approved Suppliers

Approved suppliers of the ERS systems/equipment are BOWMAN, CATIPILLAR, ABB, WILSONS, or Owner approved reputable producers of such equipment.

4.0 TECHNICAL DATA SHEETS

The contractor shall provide the ERS using the following specification tables for basis of design. The data listed is the minimum requirements for all equipment and designs.

Table 4.0.1: Existing Generator Description at Bagh-e-Pol DPP

| Item | Description/Details | Unit | Specified |
|------|------------------------------|-------------|------------------------------|
| 1 | Quantity Required | Each | 4 engines for enhancement |
| 1.1 | Type Recovery | Type | ERS |
| 1.2 | AC Power | Phase | 3 |
| 1.3 | Generator brand | Name | CAT |
| 1.4 | Engine Type | Type | 4 cycle, V-16 |
| 1.5 | Model | No. | 3516B |
| 1.6 | Generator Manufacturing Year | Year | App. 2012 |
| 1.7 | Fuel Type | | Diesel |
| 1.8 | Power Rating | KW | 1600 |
| 1.9 | Frequency | Hz | 50 |
| 1.10 | Speed | RPM | 1500 |
| 1.11 | Number of Turbochargers | Count | 4 / engine, 2 exhaust stacks |
| 1.12 | Voltage Output | Volts | 415 |
| 1.13 | Seismic Zone (IBC) | | Moderate hazard – Zone 2 |
| 1.14 | Ambient Temperature Range | | 0°C to 48°C |
| 1.15 | Ice Build-up | mm | 15 |
| 1.16 | Elevation Above Sea Level | Meters | 1000m |
| 1.17 | Wind Speed | --- | High |
| 1.18 | Humidity Environment | RH | 5 – 90 % |
| 2.0 | Typical Operating Conditions | | |
| 2.1 | Average Load Factor | % of Rating | 70 |
| 2.2 | Average Use | Hr/year | 19400 |
| 2.3 | Average Fuel Consumption | L/Hr | 288 |

Table 4.0 2: Existing Generator Description at Bresha Kot DPP

| Item | Description/Details | Unit | Specified |
|------|---------------------|------|---------------------------|
| 1 | Quantity Required | Each | 4 engines for enhancement |

Kandahar Area Diesel Optimization

| | | | |
|------|------------------------------|-------------|------------------------------|
| 1.1 | Type Recovery | Type | ERS |
| 1.2 | AC Power | Phase | 3 |
| 1.3 | Generator brand | Name | MTU |
| 1.4 | Engine Type | Type | 4 cycle, V-16 |
| 1.5 | Model | No. | 1800FXC5D (G63) |
| 1.6 | Generator Manufacturing Year | Year | App. 2013 |
| 1.7 | Fuel Type | | Diesel |
| 1.8 | Power Rating | KW | 1525Kw |
| 1.9 | Frequency | Hz | 50 |
| 1.10 | Speed | RPM | 1500 |
| 1.11 | Number of Turbochargers | Count | 4 / engine, 2 exhaust stacks |
| 1.12 | Voltage Output | Volts | 415 |
| 1.13 | Seismic Zone (IBC) | | Moderate hazard – Zone 2 |
| 1.14 | Ambient Temperature Range | | 0°C to 48°C |
| 1.15 | Ice Build-up | mm | 15 |
| 1.16 | Elevation Above Sea Level | Meters | 1000m |
| 1.17 | Wind Speed | --- | High |
| 1.18 | Humidity Environment | RH | 5 – 90 % |
| 2.0 | Typical Operating Conditions | | |
| 2.1 | Average Load Factor | % of Rating | 81 |
| 2.2 | Average Use | Hr/year | 19400 |
| 2.3 | Average Fuel Consumption | L/Hr | 288 |

Kandahar Area Diesel Optimization

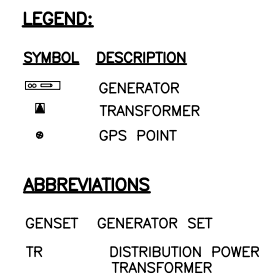
Table 5.0 3: Existing Generator Description at SIP DPP

| Item | Description/Details | Unit | Specified |
|------|------------------------------|-------------|------------------------------|
| 1 | Quantity Required | Each | 4 engines for enhancement |
| 1.1 | Type Recovery | Type | ERS |
| 1.2 | AC Power | Phase | 3 |
| 1.3 | Generator brand | Name | CAT |
| 1.4 | Engine Type | Type | 4 cycle, V-16 |
| 1.5 | Model | No. | 3516B |
| 1.6 | Generator Manufacturing Year | Year | App. 2012 |
| 1.7 | Fuel Type | | Diesel |
| 1.8 | Power Rating | KW | 1600 |
| 1.9 | Frequency | Hz | 50 |
| 1.10 | Speed | RPM | 1500 |
| 1.11 | Number of Turbochargers | Count | 4 / engine, 2 exhaust stacks |
| 1.12 | Voltage Output | Volts | 415 |
| 1.13 | Seismic Zone (IBC) | | Moderate hazard – Zone 2 |
| 1.14 | Ambient Temperature Range | | 0°C to 48°C |
| 1.15 | Ice Build-up | mm | 15 |
| 1.16 | Elevation Above Sea Level | Meters | 1000m |
| 1.17 | Wind Speed | --- | High |
| 1.18 | Humidity Environment | RH | 5 – 90 % |
| 2.0 | Typical Operating Conditions | | |
| 2.1 | Average Load Factor | % of Rating | 70 |
| 2.2 | Average Use | Hr/year | 19400 |
| 2.3 | Average Fuel Consumption | L/Hr | 288 |

APPENDICES


APPENDIX A

DDP LOCATION MAPS



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USAID – OEGI
WOLTO083 AMD2
KANDAHAR POWER PLANTS
ASSESSMENTS
EXISTING BOGH-E-POL POWER
PLANT SITE PLAN

SHEET
REFERENCE
NUMBER:

E-001

ISSUED
FOR
INFORMATION

DRAFT

EXISTING BOGH-E-POL
POWER PLAN SITE PLAN
SCALE: 1:100

UNLESS OTHERWISE NOTED, LINEAR
DIMENSIONS SHOWN ARE IN MILLIMETERS.

1 0 10 20 30 40 50 60 70 80 90
1:100

NOT FOR CONSTRUCTION

EXISTING BRESHNA KOT
DEISEL POWER PLAN
SCALE: 1:50

DRAFT

USAID – OEGI
WOLTO083 AMD2
KANDAHAR POWER PLANTS
ASSESSMENTS
EXISTING BRESHNA KOT DEISEL
POWER PLAN

SHEET
REFERENCE
NUMBER:

E-002



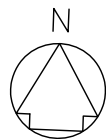
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EXISTING SIP (SMALL)
DEISEL POWER PLANT
SCALE: 1:300



LEGEND:

| <u>SYMBOL</u> | <u>DESCRIPTION</u> |
|---|--------------------|
|  | GENERATOR |
|  | TRANSFORMER |
|  | GPS POINT |


ABBREVIATIONS

| | |
|-----|-------------------------------------|
| GEN | – GENERATOR |
| TR | – POWER DISTRIBUTION TRANSFORMER |
| T | – FUEL TANKS |
| SIP | – SHORANDAM INDUSTRIAL PARK |

DRAFT

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USAID — OEGI
WOLTO083 AMD2
KANDAHAR POWER PLANTS
ASSESSMENTS
EXISTING SIP (SMALL) DIESEL
POWER PLANT

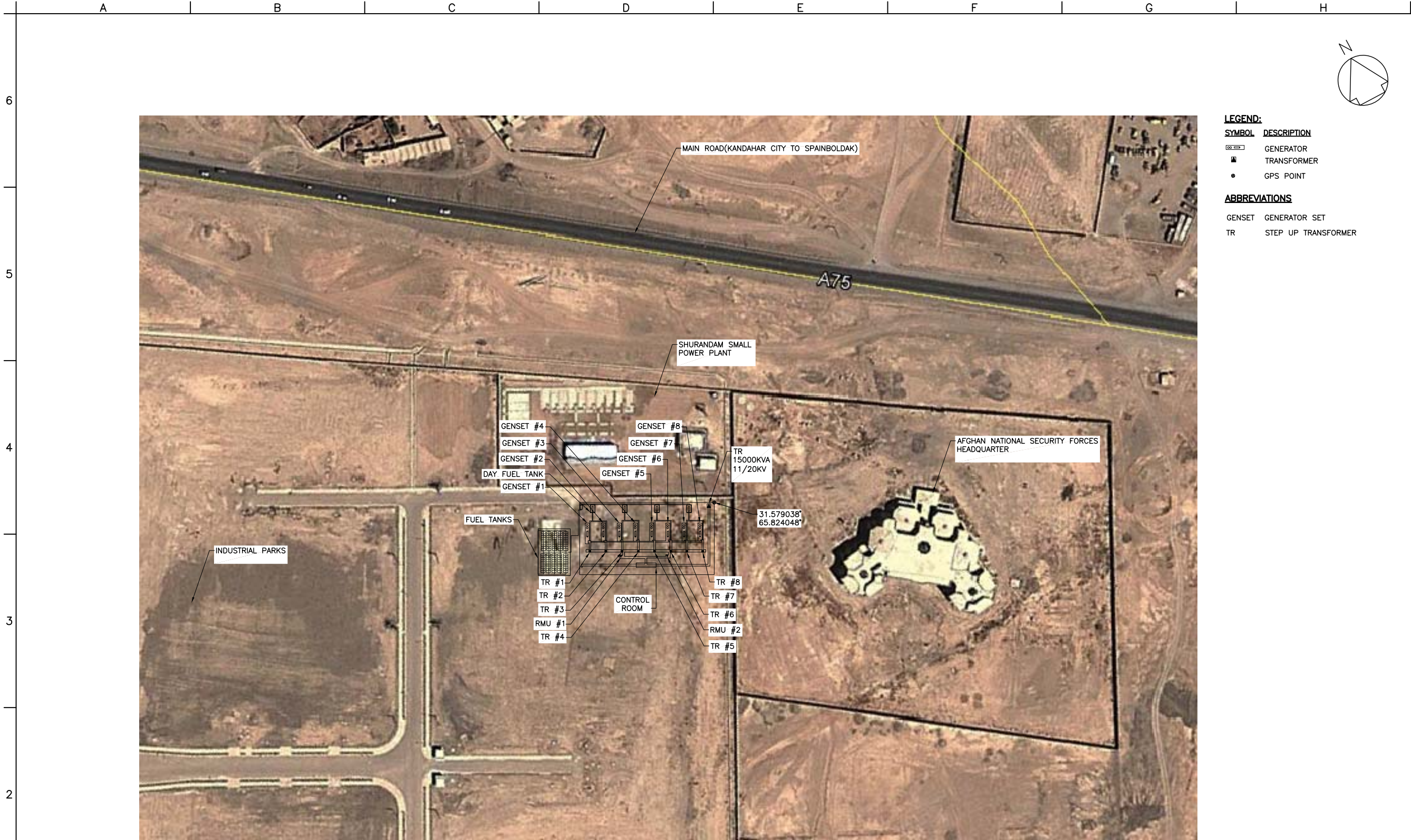
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E-003

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EXISTING SHURANDAM (BIG) SIP
POWER PLAN SITE PLAN
SCALE: 1:100

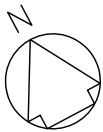
UNLESS OTHERWISE NOTED, LINEAR
DIMENSIONS SHOWN ARE IN MILLIMETERS.

LEGEND:

| SYMBOL | DESCRIPTION |
|--------|-------------|
| | GENERATOR |
| | TRANSFORMER |
| | GPS POINT |

ABBREVIATIONS

| | |
|--------|---------------------|
| GENSET | GENERATOR SET |
| TR | STEP UP TRANSFORMER |



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DESIGNED BY: SH
DATE: 11/23/2014
DRAWN BY: SH
SUBMITTED BY: TETRA TECH
CHECKED BY: MAY
CAD FILE NAME: E-004

A E S P

USAID - OEGI
WOLTO083 AMD2
KANDAHAR POWER PLANTS
ASSESSMENTS
EXISTING SHURANDAM (BIG) SIP
POWER PLANT SITE PLAN

SHEET
REFERENCE
NUMBER:

E-004

NOT FOR CONSTRUCTION

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APPENDIX B
SPECIFICATIONS FOR ENERGY SYSTEM

SECTION 48 11 00_Rev1

HEAT RECOVERY SYTEM

PART 1: GENERAL

This specification describes the technical features and details for:

Description: waste heat recovery system from operational Diesel
GEN/SET.

Quantity: (12) complete units.

1.1 REFERENCES

The design and performance of the waste heat recovery equipment covered by this specification shall conform to the latest relevant British, IEC, or American Standards. The equipment shall conform to one of the following sets of standards:

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

HEAT RECOVERY SYTEM

1.2 GENERAL REQUIRMENTS

The waste heat recovery equipment to produce utility electrical power needs to be designed and procured for installation and satisfactory operation outdoors under the conditions set forth below. The equipment is to be furnished complete, installed, and tested.

The subject waste heat is present in two distinctive forms. First, the engine jacket cooling water. Second, Exhaust gases (flue gases) produced by the internal combustion process of these engines. There is no limitation as to which technology or combination of technologies can be employed and utilized to achieve this process.

The qualified Bidders should highlight the reliability of their system by presenting examples of successful experience on past or existing installations and operations of their system along with satisfactory customer references.

All equipment under these specifications shall be manufactured in accordance with the latest editions of all applicable codes and standards of IEC-EN or ANSI/IEEE, ANSI, ASTM, NEMA organization standards and all other applicable codes and standards. Manufacturers may choose to consistently follow IEC or ANSI/IEEE standards based on the manufacturer's usual compliance ratings. Specific standard references from one organization may be substituted by an equivalent standard from another organization for consistency of the manufacturer's compliance ratings. For example, an IEEE standard reference may be substituted by an equivalent IEC standard reference.

1.3 SCOPE OF WORK

The successful bidder shall design, procure, deliver, install and test the complete proposed system for the recovery of waste heat produced by generator sets powered by reciprocating engines running on diesel fuel at the Bag-e-Pol, Breshna Kot, and SIP diesel power plants (DPP), and converting it into useful 400V, three-phase, 50Hz utility electrical energy. This co-generated electrical power will then be synchronized with the local AC power bus. It will be the responsibility of bidder to integrate all the pertinent meters, electrical protection and other miscellaneous equipment required for the proper, reliable and safe functioning of the proposed system.

The overall design is for a module type configuration which is installed in a steel shipping container. The container shall house all technical equipment required for ERS power production. Otherwise than interface points, the entire system shall be fully installed and tested in the shipping container. Providing for minimal field connection points.

The system shall be capable of decreasing fuel oil consumption by at least 6.5% at 1000kW DG power production per system.

HEAT RECOVERY SYTEM

1.4 SUBMITTALS

The manufacture shall supply the following preliminary drawings, catalogs, details, reports, specifications, schedules, cost reports and constrains for the acceptance of the preliminary design:

- a) Outdoor instrumentation equipment control wiring termination blocks
- b) Equipment cut sheets and catalogs
- c) Layout of the equipment
- d) Design parameters and description of the main elements
- e) Mass and energy balance
- f) P&ID (Piping and Instrumentation Diagram)
- g) Interfaces generic diagram
- h) Main equipment specifications
- i) Delivery time schedule
- j) Implementation schedule
- k) Commercial conditions
- l) Maintenance schedule highlighting the following:
 - o Frequency of minor and major maintenance operations with details about generators shutdown requirements.
 - o Estimated labour required (in hours) for each task.
 - o Fluids required (oil, coolants, water...) with associated specs and estimated annual volume.
 - o Frequency of parts replacement (spares).
 - o The technical profile of people required to ensure the proper use and maintenance aspects of the system.
- m) Cost reports
 - o Overall complete implementation costs, per unit (if relevant) and/or overall.
 - o Detail of operating costs, per unit (if relevant) and/or overall, including at least
 - 1. Maintenance costs over 5 years
 - 2. Approximate spare parts costs
- n) Generated power reports
 - o Gross generated power(kWe), per generator and/or overall for site.
 - o Net generated power(kWe), per generator and/or overall for site (taking into account any auxiliary, ancillary equipment)

Note: It is understood that performance will also be considered and Compared between bidders, taking into account fuel consumption Of the generators once the system has been implemented.

- O) A brief report on how the installation will be done, an estimate of the timing involved and the likely limits or constraints inherent to their systems (in terms of space, material needed) involved.

HEAT RECOVERY SYTEM

PART 2: PRODUCTS

2.1 Waste Heat Recovery Equipment Complete Control and Instrumentation

a) General

The equipment shall be furnished in accordance with this section. The manufacturer shall provide a standard design for the items within the scope of the specification. All materials and equipment shall be standard product of a manufacturer regularly engaged in the manufacture of the product and shall be in accordance with accepted industry practices for waste heat recovery systems.

The requirements of the waste heat recovery equipment Specification Table 1 shall govern should conflicts occur between them and the written text of these specifications.

b) Codes and Standards

All equipment supplied under this specification shall conform to the applicable standards listed in Section 1.1 above. A steel stairway shall be supplied & installed as part of the ERS.

c) Equipment Required

The manufacturer shall furnish waste heat recovery equipment as specified on the Specification Table 1 included at the end of this section. Waste heat recovery equipment furnished shall be complete with all accessories ready for mounting, assembly, connection, and immediate service.

The quantity and types of waste heat recovery equipment furnished shall be as indicated on the Specification Table 1.

The system is expected to be mounted on top of existing container mounted DGs. It will allow incorporation of two exhaust ports in the floor, connecting to two similar exhaust ports in the ceiling of the enclosure. The enclosure shall house all ERS equipment including generation, power, lubrication, cooling & control systems.

The installation requirements include a standard steel stairs and landing from ground level to access the ERS enclosure.

d) Ratings

The waste heat recovery equipment shall be rated as indicated in Specification Table 1.

The following aspects should be the main criteria for the equipment selection:

- o Performance in terms of net power produced
- o Ease of installation
- o Modularity
- o Reliability and ease of maintenance
- o Footprint (space required)
- o Weight
- o System complexity

The waste heat recovery equipment shall be suitable for operation at the altitude specified on Specification Table 1.

HEAT RECOVERY SYTEM

e) Construction Details

Waste heat recovery equipment shall be designed and fabricated in accordance with the latest revisions of the applicable codes and standards.

Waste heat recovery equipment shall be furnished with all field connection hardware for field mounting on existing containerized generators. All hardware shall be hot-dip galvanized.

PART 3: EXECUTION

3.0 SITE PRE-TESTS

In the early days after award the Bidder shall conduct a pre-test of a Bagh-e-Pol DG system of their choice. Data provided by this test shall be utilized to enhance all remaining DGs in the program. All interface technical data shall also be obtained during this period.

3.1 FACTORY TESTING

Before shipping, the Manufacturer shall test the equipment per the applicable standard tests. Two (2) copies of the test reports shall be forwarded to the Owner and the Engineer prior to shipping. The Manufacturer shall obtain release from the Owner prior to shipment.

3.2 INSPECTION BY THE ENGINEER/OWNER

The Engineer and/or Owner shall be allowed to witness testing performed by the Seller, as well as inspect the equipment at any time. Inspection by the Engineer / Owner shall not relieve the Seller of his responsibility to inspect the equipment, confirm all requirements of testing, and supply complete equipment which satisfies all requirements of these Specifications.

3.3 SPECIAL SHIPPING REQUIREMENTS

Bidder will supply with his bid approximate gross weights, together with the overall physical dimensions of equipment of subassembly as packed for shipment, and a written proposal describing, briefly, the design, contents and number of shipping units.

3.4 ASSEMBLY

In general, the only field connection work shall be;

- Exhaust (dual) in & out of ERS enclosure.
- Relocation of existing mufflers (2/DG) to above ERS enclosure.
- Controls as necessary to the DG.
- 400 volt, 3 phase, power to the DG busses.

HEAT RECOVERY SYTEM

3.5 FIELD & ACCEPTANCE TESTING

The Manufacturer shall submit a "Field Acceptance Test Procedure" document for approval at least six (6) weeks prior to expected formal Acceptance Testing. The document shall, as a minimum, detail step-by-step procedures to demonstrate complete and proper operation of the system. It shall also document all test equipment to be used, including their calibration date. Only equipment with certified calibration lables showing proper calibration performed within the last 12 months shall be used. The Manufacturer shall provide all necessary equipment for all tests. Equipment panel meters shall not be used in lieu of external test equipment.

As part of the Field Acceptance Test Procedure a test shall be included to measure level of fuel savings. This procedure shall document fuel consumed with & without the ERS while producing a total of 1000kW. Bidder shall supply all test equipment for this procedure, including required load banks.

After full field installation on a diesel generator, each system shall be tested by Manufacturer technicians (typical Manufacturer tests may be utilized) to assure proper operation. Upon satisfactory testing, the system shall undergo additional field tests per the approved Field Acceptance Test Procedure.

The Engineer and/or Owner shall be required to witness testing performed by the Seller. Inspection by the Engineer / Owner shall not relieve the Seller of his responsibility to inspect the equipment, confirm all requirements of testing, and supply complete equipment which satisfies all requirements of these Specifications.

Any changes/calibrations/repairs required during the Field Acceptance Test Procedure shall require a re-start of the entire Field Acceptance Test Procedure. Acceptance of the equipment shall not occur until all parts of the Field Acceptance Test Procedure have been successfully demonstrated to the satisfaction of the Engineer and/or Owner, and all documents have been signed by all parties.

3.5 APPROVED SUPPLIERS

Approved suppliers of the waste heat recovery systems /equipment are BOWMAN POWER, CATERPILLAR, ABB, WILSONS, or Owner approved reputable producers of such equipment.

3.6 Training

The successful bidder will also be responsible for the training of local operators on how to operate and maintain the system. This should include but not limited to how local operators of the system can "by-pass" or shutdown the proposed system and be able to use the generators in case of a system failure (or maintenance requirements of the proposed system).

SECTION 48 11 00_Rev1

HEAT RECOVERY SYTEM

| EXISTING GENERATOR DESCRIPTION #1 | UNIT | VALUE |
|-----------------------------------|--------|---------------------------|
| Quantity | Each | 8 engines for enhancement |
| AC Power | phase | 3 |
| Generator brand | name | CAT |
| Generator type | type | Turbo-Charger, 4 cycle |
| Generator Manufacturing Year | year | Appx 2012 |
| Fuel Type | | Diesel |
| Power Rating | KW | 1600kW max, 1120kW normal |
| Frequency | Hz | 50 |
| SPEED | RPM | 1500 |
| Number of Turbochargers | count | 4 / engine |
| Voltage Output | VOLTS | 400 |
| Seismic Zone (IBC) | | Moderate hazard - Zone 2 |
| Ambient Temperature Range | | 0°C to 48°C |
| Ice Build-up | mm | 15 |
| Elevation Above Sea Level | meters | 1000m |
| Wind Speed | --- | High |
| Humidity Environment | RH | 5 - 90 % |

SECTION 48 11 00_Rev1

HEAT RECOVERY SYTEM

| EXISTING GENERATOR DESCRIPTION #2 | UNIT | VALUE |
|-----------------------------------|--------|---------------------------|
| Quantity | Each | 4 engines for enhancement |
| AC Power | phase | 3 |
| Generator brand | name | MTU |
| Generator type | type | Turbo-Charger, 4 cycle |
| Generator Manufacturing Year | year | Appx 2012 |
| Fuel Type | | Diesel |
| Power Rating | KW | 1525kW max, 1220kW normal |
| Frequency | Hz | 50 |
| SPEED | RPM | 1500 |
| Number of Turbochargers | count | 4 / engine |
| Voltage Output | VOLTS | 400 |
| Seismic Zone (IBC) | | Moderate hazard - Zone 2 |
| Ambient Temperature Range | | 0°C to 48°C |
| Ice Build-up | mm | 15 |
| Elevation Above Sea Level | meters | 1000m |
| Wind Speed | --- | High |
| Humidity Environment | RH | 5 - 90 % |

Specification Table 1

| ERS DESCRIPTION UNIT | UNIT | REQUIRED VALUE |
|------------------------------|--------|-------------------------------|
| Quantity | Each | 12 |
| Type | | Waste heat recovery equipment |
| AC Power | phase | 3 |
| AC Power | Volts | 400 VAC Phase-to-Phase |
| AC Power | Freq | 50 Hz |
| Power Rating | KW | 120kW / DG Max |
| Mounting Type | | Steel Enclosure, Outdoor |
| Incoming Exhaust Connections | 2 | Through Floor of Enclosure |
| Leaving Exhaust Connections | 2 | Through Ceiling of Enclosure |
| Seismic Zone (IBC) | | Moderate hazard - Zone 2 |
| Ambient Temperature Range | | 0°C to 48°C |
| Ice Build-up | mm | 15 |
| Elevation Above Sea Level | meters | 1000m |
| Wind Speed | --- | High |
| Humidity Environment | RH | 5 - 90 % |

--- End of Section ---

APPENDIX C

PRICING SHEETS

| | | | | |
|--|--------|------------|-------------|--------|
| Energy Recovery System Pricing Summary Sheet Energy Recovery Systems for Kandahar Diesel Generators | | | | |
| | | | | |
| Date of Bid | | | | |
| | | | | |
| Bidder Data | | | | |
| Company Name | | | | |
| Technical Offer Number | | | | |
| Date of Bid | | | | |
| Bidder Data | | | | |
| Title of Authorized Signatory | | | | |
| | | | | |
| Bid Summary for: | Totals | Bagh-e-Pol | Breshna Kot | SIP |
| Schedule No. 1 (Supply of Major Plant and Equipment) | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Schedule No. 2 (Supply of Electrical Plant and Equipment) | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Schedule No. 3 (Mandatory Spare Parts) | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Schedule No. 4 (Standard Tools) | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Schedule No. 5 (Design, Drawings and Documentation) | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Schedule No. 6 (Installation and Other Charges) | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Schedule No. 7 (Transfer of Knowledge) | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Sub-Total | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Grand Total | | | | \$0.00 |
| Contingencies (15 % of Grand Total) | | | | \$0.00 |
| Contract Price | | | | \$0.00 |

I hereby certify that the above information is correct.

Name of Bidder:

Seal:

Signature of Bidder:

| Design, Procurement, Construction, Testing, and Commissioning of ERS at Bagh-e-Pol | | | | | |
|--|---|--|-----|------------|--------|
| Schedule No. 1 | | | | | |
| DPP: Supply of Major Plant and Equipment | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 1.1 | Supply of Energy Recovery System Components | EA | 4 | | \$0.00 |
| 1.2 | Supply of DG Modification Parts | EA | 4 | | \$0.00 |
| 1.3 | Supply of Rebuild Parts for Existing Plant DG | EA | 0 | | \$0.00 |
| 1.4 | Supply of Materials for Exchange of DG with Spare DG | EA | 0 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 1 Total | | | \$0.00 |
| Schedule No. 2 | | | | | |
| DPP: Supply of Electrical Plant and Equipment | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 2.1 | Supply of 400 Volt Electrical Interface Power Equipment | EA | 4 | | \$0.00 |
| 2.2 | Supply of Electrical Interface Control Equipment | EA | 4 | | \$0.00 |
| 2.3 | Protection System | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 2 Total | | | \$0.00 |
| Schedule No. 3 | | | | | |
| DPP: Mandatory Spare Parts | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 3.1 | Protection System | LS | 1 | | \$0.00 |
| 3.2 | 400 Volt Power Equipment | LS | 1 | | \$0.00 |
| 3.3 | Control System | LS | 1 | | \$0.00 |
| 3.4 | Cooling System | LS | 1 | | \$0.00 |
| 3.5 | Engine/PMG System | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 3 Total | | | \$0.00 |

I hereby certify that the above information is correct.

Name of Bidder:

Seal:

Signature of Bidder:

| Design, Procurement, Construction, Testing, and Commissioning of ERS at Bagh-e-Pol | | | | | |
|--|--|--|-----|------------|--------|
| | | | | | |
| Schedule No. 4 | | | | | |
| DPP: Standard Tools | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 4.1 | ERS Maintenance Tools & Appliances | LS | 1 | | \$0.00 |
| 4.2 | Test Equipment | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 4 Total | | | \$0.00 |
| | | | | | |
| Schedule No. 5 | | | | | |
| DPP: Design, Drawings and Documentation | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 5.1 | Structural Design And General Arrangement Drawings | LS | 1 | | \$0.00 |
| 5.2 | Site Electrical Modifications Design Drawings | LS | 1 | | \$0.00 |
| 5.3 | Control Circuits & Wiring Drawings | LS | 1 | | \$0.00 |
| 5.4 | General Construction Drawings | LS | 1 | | \$0.00 |
| 5.5 | As Built Drawings | LS | 1 | | \$0.00 |
| 5.6 | Maintenance Manual And Completion Report | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 5 Total | | | \$0.00 |

I hereby certify that the above information is correct.

Name of Bidder:

Seal:

Signature of Bidder:

| Design, Procurement, Construction, Testing, and Commissioning of ERS at Bagh-e-Pol | | | | | |
|--|---|--|-----|------------|--------|
| Schedule No. 6 | | | | | |
| DPP: Installation and Other Charges | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 6.1 | Project Management | LS | 1 | | \$0.00 |
| 6.2 | Project Reporting | LS | 1 | | \$0.00 |
| 6.3 | Project Insurance | LS | 1 | | \$0.00 |
| 6.4 | Installation of Energy Recovery System Components | EA | 4 | | \$0.00 |
| 6.5 | Installation of DG Modification Parts | EA | 4 | | \$0.00 |
| 6.6 | Installation of Rebuild Parts for Existing Plant DG | EA | 0 | | \$0.00 |
| 6.7 | Installation of Materials for Exchange of DG with Spare Unit | EA | 0 | | \$0.00 |
| 6.8 | Relocation of Existing Diesel Generator | EA | 0 | | \$0.00 |
| 6.9 | Installation of 400 Volt Electrical Interface Power Equipment | EA | 4 | | \$0.00 |
| 6.10 | Installation of Electrical Interface Control Equipment | EA | 4 | | \$0.00 |
| 6.11 | Pre-Design Test | EA | 1 | | \$0.00 |
| 6.12 | Testing and Commissioning | EA | 4 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 6 Total | | | \$0.00 |
| Schedule No. 7 | | | | | |
| DPP: Transfer of Knowledge | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 7.1 | Training of Operation & Maintenance Management Staff | LS | 1 | | \$0.00 |
| 7.2 | On-Site Training During Construction and Commissioning | LS | 1 | | \$0.00 |
| 7.3 | Training of Operation & Maintenance General Staff | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 7 Total | | | \$0.00 |
| | | Total | | | \$0.00 |

I hereby certify that the above information is correct.

Name of Bidder:

Seal:

Signature of Bidder:

| Design, Procurement, Construction, Testing, and Commissioning of ERS at Breshna Kot | | | | | |
|---|---|--|-----|------------|--------|
| Schedule No. 1 | | | | | |
| DPP: Supply of Major Plant and Equipment | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 1.1 | Supply of Energy Recovery System Components | EA | 4 | | \$0.00 |
| 1.2 | Supply of DG Modification Parts | EA | 4 | | \$0.00 |
| 1.3 | Supply of Rebuild Parts for Existing Plant DG | EA | 0 | | \$0.00 |
| 1.4 | Supply of Materials for Exchange of DG with Spare DG | EA | 0 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 1 Total | | | \$0.00 |
| Schedule No. 2 | | | | | |
| DPP: Supply of Electrical Plant and Equipment | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 2.1 | Supply of 400 Volt Electrical Interface Power Equipment | EA | 4 | | \$0.00 |
| 2.2 | Supply of Electrical Interface Control Equipment | EA | 4 | | \$0.00 |
| 2.3 | Protection System | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 2 Total | | | \$0.00 |
| Schedule No. 3 | | | | | |
| DPP: Mandatory Spare Parts | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 3.1 | Protection System | LS | 1 | | \$0.00 |
| 3.2 | 400 Volt Power Equipment | LS | 1 | | \$0.00 |
| 3.3 | Control System | LS | 1 | | \$0.00 |
| 3.4 | Cooling System | LS | 1 | | \$0.00 |
| 3.5 | Engine/PMG System | LS | 1 | | \$0.00 |
| | | | | | |
| | | Schedule No. 3 Total | | | \$0.00 |

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Name of Bidder:

Seal:

Signature of Bidder:

| Design, Procurement, Construction, Testing, and Commissioning of ERS at Breshna Kot | | | | | |
|---|--|--|-----|------------|--------|
| Schedule No. 4 | | | | | |
| DPP: Standard Tools | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 4.1 | ERS Maintenance Tools & Appliances | LS | 1 | | \$0.00 |
| 4.2 | Test Equipment | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 4 Total | | | \$0.00 |
| Schedule No. 5 | | | | | |
| DPP: Design, Drawings and Documentation | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 5.1 | Structural Design And General Arrangement Drawings | LS | 1 | | \$0.00 |
| 5.2 | Site Electrical Modifications Design Drawings | LS | 1 | | \$0.00 |
| 5.3 | Control Circuits & Wiring Drawings | LS | 1 | | \$0.00 |
| 5.4 | General Construction Drawings | LS | 1 | | \$0.00 |
| 5.5 | As Built Drawings | LS | 1 | | \$0.00 |
| 5.6 | Maintenance Manual And Completion Report | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 5 Total | | | \$0.00 |

I hereby certify that the above information is correct.

Name of Bidder:

Seal:

Signature of Bidder:

| Design, Procurement, Construction, Testing, and Commissioning of ERS at Breshna Kot | | | | | |
|---|---|--|-----|------------|--------|
| Schedule No. 6 | | | | | |
| DPP: Installation and Other Charges | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 6.1 | Project Management | LS | 1 | | \$0.00 |
| 6.2 | Project Reporting | LS | 1 | | \$0.00 |
| 6.3 | Project Insurance | LS | 1 | | \$0.00 |
| 6.4 | Installation of Energy Recovery System Components | EA | 4 | | \$0.00 |
| 6.5 | Installation of DG Modification Parts | EA | 4 | | \$0.00 |
| 6.6 | Installation of Rebuild Parts for Existing Plant DG | EA | 0 | | \$0.00 |
| 6.7 | Installation of Materials for Exchange of DG with Spare Unit | EA | 0 | | \$0.00 |
| 6.8 | Relocation of Existing Diesel Generator | EA | 0 | | \$0.00 |
| 6.9 | Installation of 400 Volt Electrical Interface Power Equipment | EA | 4 | | \$0.00 |
| 6.10 | Installation of Electrical Interface Control Equipment | EA | 4 | | \$0.00 |
| 6.11 | Pre-Design Test | EA | 0 | | \$0.00 |
| 6.12 | Testing and Commissioning | EA | 4 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| Schedule No. 6 Total | | | | | \$0.00 |
| Schedule No. 7 | | | | | |
| DPP: Transfer of Knowledge | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 7.1 | Training of Operation & Maintenance Management Staff | LS | 1 | | \$0.00 |
| 7.2 | On-Site Training During Construction and Commissioning | LS | 1 | | \$0.00 |
| 7.3 | Training of Operation & Maintenance General Staff | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| Schedule No. 7 Total | | | | | \$0.00 |
| Total | | | | | \$0.00 |

I hereby certify that the above information is correct.

Name of Bidder:

Seal:

Signature of Bidder:

| Design, Procurement, Construction, Testing, and Commissioning of ERS at Shorandam Industrial Park (SIP) | | | | | |
|---|---|-------|-----|--|---------------|
| Schedule No. 1 | | | | | |
| DPP: Supply of Major Plant and Equipment | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 1.1 | Supply of Energy Recovery System Components | EA | 4 | | \$0.00 |
| 1.2 | Supply of DG Modification Parts | EA | 4 | | \$0.00 |
| 1.3 | Supply of Rebuild Parts for Existing Plant DG | EA | 0 | | \$0.00 |
| 1.4 | Supply of Materials for Exchange of DG with Spare DG | EA | 0 | | \$0.00 |
| | | | | Shipping, Handling & Inland Transportation | |
| | | | | Schedule No. 1 Total | \$0.00 |
| Schedule No. 2 | | | | | |
| DPP: Supply of Electrical Plant and Equipment | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 2.1 | Supply of 400 Volt Electrical Interface Power Equipment | EA | 4 | | \$0.00 |
| 2.2 | Supply of Electrical Interface Control Equipment | EA | 4 | | \$0.00 |
| 2.3 | Protection System | LS | 1 | | \$0.00 |
| | | | | Shipping, Handling & Inland Transportation | |
| | | | | Schedule No. 2 Total | \$0.00 |
| Schedule No. 3 | | | | | |
| DPP: Mandatory Spare Parts | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 3.1 | Protection System | LS | 1 | | \$0.00 |
| 3.2 | 400 Volt Power Equipment | LS | 1 | | \$0.00 |
| 3.3 | Control System | LS | 1 | | \$0.00 |
| 3.4 | Cooling System | LS | 1 | | \$0.00 |
| 3.5 | Engine/PMG System | LS | 1 | | \$0.00 |
| | | | | Shipping, Handling & Inland Transportation | |
| | | | | Schedule No. 3 Total | \$0.00 |

I hereby certify that the above information is correct.

Name of Bidder:

Seal:

Signature of Bidder:

| Design, Procurement, Construction, Testing, and Commissioning of ERS at Shorandam Industrial Park (SIP) | | | | | |
|---|--|--|-----|------------|--------|
| Schedule No. 4 | | | | | |
| DPP: Standard Tools | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 4.1 | ERS Maintenance Tools & Appliances | LS | 1 | | \$0.00 |
| 4.2 | Test Equipment | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 4 Total | | | \$0.00 |
| Schedule No. 5 | | | | | |
| DPP: Design, Drawings and Documentation | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 5.1 | Structural Design And General Arrangement Drawings | LS | 1 | | \$0.00 |
| 5.2 | Site Electrical Modifications Design Drawings | LS | 1 | | \$0.00 |
| 5.3 | Control Circuits & Wiring Drawings | LS | 1 | | \$0.00 |
| 5.4 | General Construction Drawings | LS | 1 | | \$0.00 |
| 5.5 | As Built Drawings | LS | 1 | | \$0.00 |
| 5.6 | Maintenance Manual And Completion Report | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 5 Total | | | \$0.00 |

I hereby certify that the above information is correct.

Name of Bidder:

Seal:

Signature of Bidder:

| Design, Procurement, Construction, Testing, and Commissioning of ERS at Shorandam Industrial Park (SIP) | | | | | |
|---|---|--|-----|------------|--------|
| Schedule No. 6 | | | | | |
| DPP: Installation and Other Charges | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 6.1 | Project Management | LS | 1 | | \$0.00 |
| 6.2 | Project Reporting | LS | 1 | | \$0.00 |
| 6.3 | Project Insurance | LS | 1 | | \$0.00 |
| 6.4 | Installation of Energy Recovery System Components | EA | 4 | | \$0.00 |
| 6.5 | Installation of DG Modification Parts | EA | 4 | | \$0.00 |
| 6.6 | Installation of Rebuild Parts for Existing Plant DG | EA | 0 | | \$0.00 |
| 6.7 | Installation of Materials for Exchange of DG with Spare Unit | EA | 0 | | \$0.00 |
| 6.8 | Relocation of Existing Diesel Generator | EA | 1 | | \$0.00 |
| 6.9 | Installation of 400 Volt Electrical Interface Power Equipment | EA | 4 | | \$0.00 |
| 6.10 | Installation of Electrical Interface Control Equipment | EA | 4 | | \$0.00 |
| 6.11 | Pre-Design Test | EA | 1 | | \$0.00 |
| 6.12 | Testing and Commissioning | EA | 4 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 6 Total | | | \$0.00 |
| Schedule No. 7 | | | | | |
| DPP: Transfer of Knowledge | | | | | |
| Item No. | Description | Units | QTY | Unit Price | Amount |
| 7.1 | Training of Operation & Maintenance Management Staff | LS | 1 | | \$0.00 |
| 7.2 | On-Site Training During Construction and Commissioning | LS | 1 | | \$0.00 |
| 7.3 | Training of Operation & Maintenance General Staff | LS | 1 | | \$0.00 |
| | | Shipping, Handling & Inland Transportation | | | |
| | | Schedule No. 7 Total | | | \$0.00 |
| | | Total | | | \$0.00 |

I hereby certify that the above information is correct.

Name of Bidder:

Seal:

Signature of Bidder:

| Schedule Number | Item No. | Item Description |
|---|----------|--|
| <u>Schedule No. 1</u> Supply of Major Plant and Equipment | 1.1 | Supply of Energy Recovery System (ERS) Components: Supply of all equipment to build an ERS. Includes; turbo-generator with PMG, power conversion electronics, controls, and cooling system. All equipment shall be packaged in a steel transport enclosure. The system shall be fully wired, plumbed, and tested; ready for install on top of existing enclosure type generators. All equipment shall be designed and manufactured IAW latest edition of the IEC standards and the rated performance specifications. |
| | 1.2 | Supply of DG Modification Parts: Supply of all mechanical equipment necessary to interface with the existing Diesel Generator (DG). Includes all new turbos, exhaust fittings, and supports (as necessary). |
| | 1.3 | Supply of Rebuild Parts for Existing DG: All parts required to perform a major overhaul (20k+ hours) of an existing diesel generator per manufacturer's procedures. Parts found faulty, but not included in manufacturer's procedures shall be provided by the Owner. |
| | 1.4 | Supply of Materials for Exchange of DG with Spare DG: Supply of all mechanical and electrical equipment necessary to remove an existing 1600kW Diesel Generator from service and install a spare one (presently on the site). Includes all material necessary to provide a 100% operational turn-key generator system. Testing of the new generation shall be included to demonstrate proper operation with remaining plant. Supplier shall furnish all test equipment & fuel. Any replacement parts found necessary on the replacement shall be provided by the Owner. |
| <u>Schedule No. 2</u> Supply of Electrical Plant and Equipment | 2.1 | Supply of 400 Volt Electrical Interface Power Components: Supply of all electrical components such as cable tray, conduits, conductors, and supports to properly connect the ERS to the plant power system. All equipment shall be designed and manufactured IAW latest edition of the IEC standards and the rated performance specifications. |
| | 2.2 | Supply of Electrical Interface Control Equipment: Supply of all wire, sensors, connectors, relays, and other components necessary to interface the ERS control to the existing DG system. |
| | 2.3 | Protection System: The Supply of surge protectors & electrical clamps to protect the supplied ERS electronics. |
| <u>Schedule No. 3</u> Mandatory Spare Parts | 3.1 | 400V Control Equipment: The Supply of supplier recommended spare relays indicator lights, and fuses. |
| | 3.2 | 400 Volt Power System: The supply of all supplier recommended spares for power distribution boards, breakers, power fuses & wires. |
| | 3.3 | Control System: Supply of supplier recommended spare parts for the electronic control & conversion cabinet. |
| | 3.4 | Cooling System: The supply of supplier recommended valves, actuators, pumps, fans, etc. to maintain ERS cooling system. |
| | 3.5 | Engine/PMG System: Supply of supplier recommended spare parts for the turbos, exhaust system, & PMG. |
| <u>Schedule No. 4</u> Standard Tools | 4.1 | ERS Maintenance Tools & Appliances: All the necessary tools required to install, inspect, and maintain the entire ERS equipment. |
| | 4.2 | Test Equipment: All the specialized test equipment that are necessary to test, maintain, and replace the ERS. |

| | | |
|---|-----|---|
| <p style="text-align: center;">Schedule No. 5 Design, Drawings and Documentation</p> | 5.1 | Structural Design And General Arrangement Drawings: Structural steel and general arrangement drawings for the equipment and support facilities of the new ERS. Design calculations, detailed design drawings, final design deliverables including detailed supporting analyses. |
| | 5.2 | Site Electrical Modifications Design Drawings: All electrical work drawings for connection of ERS sub components and interface to existing plant electrical systems. |
| | 5.3 | Control Circuits & Wiring Drawings: The control panels and the wiring connections drawings showing all the control wires from the control panels to existing equipment. Shall also include internal schematics & point to point wiring. |
| | 5.4 | General Construction Drawings: Construction Drawings of all the civil and steel structures (including stairs from ground level to elevated ERS enclosure) showing the construction sequencing for all these structures in the ERS installation. |
| | 5.5 | As Built Drawings: Updated final documents and design drawings showing all the modifications made on the designs in the field, all CAD drawings for design, construction and installation. |
| | 5.6 | Maintenance Manual And Completion Report: All the equipment maintenance, repair and adjustments manuals, and full set of assembly drawings including wiring diagrams. Completion report for each section of the works showing the acceptable testing and proper operations of all the installed equipment. Complete instructions for operations, apparatus lists, and spare parts lists containing information needed for ordering all equipment supplied under the contract. The delivery of the following manuals: general description of the equipment, operating instructions that are suitable for training of personnel, general maintenance instructions, spare parts manuals, all layout, and installation drawings. |
| <p style="text-align: center;">Schedule No. 6 Installation and Other Charges</p> | 6.1 | Project Management: Planning, execution, monitoring and closing all the design, procurement, construction, testing and commissioning activities and ensuring they are carried out IAW the relevant technical standards and design specifications. |
| | 6.2 | Project Reporting: The set up of a reporting system from the beginning until the end of the project in which the frequency, format, contents, and the level of details for these reports will be maintained throughout the life cycle of the project. |
| | 6.3 | Project Insurance: Coverage for any bodily injury or property damage during the performance of the work. Coverage for faulty workmanship. Coverage for error and omission in the design of the project. Coverage for damage caused by hazard materials. Coverage for damage caused by non-excusable delay. The Coverages shall also cover damages to existing equipment during and after construction. |
| | 6.4 | Installation of Energy Recovery System (ERS) Components: Installation of all equipment to build a n ERS. Includes; turbo-generator with PMG, power conversion electronics, controls, and cooling system. All equipment shall be designed and manufactured IAW latest edition of the IEC standards and the rated performance specifications. |
| | 6.5 | Installation of DG Modification Parts: Installation of all mechanical equipment necessary to interface with the existing Diesel Generator (DG). Includes all new turbos, exhaust fittings, and supports (as required). |
| | 6.6 | Installation of Rebuild Parts for Existing DG: Installation of all parts required to perform a major overhaul (20k+ hours) of an existing diesel generator per manufacturer's procedures. Parts found faulty, but not included in manufacturer's procedures shall be provided by the Owner, installed by Bidder without additional charge. |

| | | |
|--|------|--|
| Schedule No. 6 (Continued) Installation and Other Charges | 6.7 | Installation of Materials for Exchange of DG with Spare DG: Installation of all mechanical and electrical equipment necessary to remove an existing 1600kW Diesel Generator from service and install a spare one (presently on the site). Includes all labor necessary to provide a 100% operational turn-key generator system. Testing of the new generation shall be included to demonstrate proper operation with remaining plant. Bidder shall furnish all labor for testing. Any replacement parts found necessary on the replacement shall be provided by the Owner, installed by Bidder without additional charge. |
| | 6.8 | Relocation of Existing Diesel Generator: All labor, tools, cranes, trucks, permits, necessary to move a 1600kW DG from Bagh-e-Pol to SIP DPP. |
| | 6.9 | Installation of 400 Volt Electrical Interface Power Components: Installation of all electrical components such as cable tray, conduits, conductors, and supports to properly connect the ERS to the plant 400V electrical system. All equipment shall be installed per IAW latest edition of the IEC standards and the rated performance specifications. |
| | 6.1 | Installation of Electrical Interface Control Equipment: Installation of all wire, sensors, connectors, relays, and other components necessary to interface the ERS control to the existing DG system. |
| | 6.11 | Pre-Design Test: Creation of the Pre-Design Test Procedure. This test shall form the basis of design modification on all other DGs of same size. It will provided data necessary for (as necessary) new engine turbos, exhaust modifications, and other mechanical work necessary to assure optimum performance of the ERS with the existing DGs. Providing all pre-design test records & documents. |
| | 6.12 | Testing and Commissioning: Creation of the Field Acceptance Test Procedure. Performance of acceptance testing of the ERS according to the Field Acceptance Test Procedure document. Providing all acceptance testing records & documents. Testing shall show the level of fuel savings at 1000kW (DG power alone) meets or exceeds the specification level. Supplier is responsible for all equipment necessary for tests. |
| Schedule No. 7 Transfer of Knowledge | 7.1 | Training of Operation & Maintenance Management Staff: Training of the maintenance management personnel on the general operation and maintenance schedules of the ERS. Furnishing of all detailed operation, service, maintenance manuals, and complete spare parts documents list for the training program. |
| | 7.2 | On-Site training during construction and commissioning: Training of personnel, workers, and laborers to handle the installation, testing and commissioning of the ERS equipment. Training for six Employer's appointed personnel on factory inspections and witnessing performance tests for the equipment. |
| | 7.3 | Training of Operation & Maintenance General Staff: Providing the maintenance general personnel a complete and detailed O&M training program on how to operate and perform the periodical maintenance procedures. Includes all course documents. |

USAID/Afghanistan

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